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ORIGINAL ARTICLES

THE HAWLEY ARCH FORM CONSIDERED FROM AN ENGINEERING STANDPOINT.—A SCIENTIFIC SUBSTITUTE*

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THROUGH my intercourse with orthodontists, I have become convinced that a very serious defect exists in the teaching of the determination of the correct arch form of the denture. The object of this paper is to acquaint those interested with the fundamental principles involved and their proper application. The investigation of a denture in malocclusion presents an engineering problem, and as such, requires an understanding of descriptive geometry, mechanics, and kinematics.

Many have an excellent perception of the various arch forms and its malformations; but what the student most needs is a guide that will enable him to analyze the facts he has to contend with, so that he may draw his conclusions through reasoning, not based on elastic "rule of thumb," but on scientific foundations.

For our purpose it is advisable to introduce new terms for the familiar nomenclature of the denture. It is believed that the changes and additions which have been made will measurably enhance the usefulness of the work.

Teeth, and other units are designated by letters, and indices are added to differentiate the various units. For the purpose of reference, a code is added.

The endeavor has been to present the results in the most simple form. No attempt is made to standardize the arch form, but the manner in which it may be standardized is indicated.

Because of the limited amount of time allotted to the reading of this paper,

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due consideration can not be given the entire dental arch or to the influence of the formation of the individual teeth or to their shape. The incisal region is dwelt upon more elaborately, while the posterior extensions are dealt with in a general way.

A complete general analysis of the dental arch in a horizontal projection is given, and a graphic method of investigation presented. It is primarily a graphic method, but this is shortened by obvious, simple analytic aids.

Black's "Descriptive Anatomy of the Human Teeth" has been the greatest aid in the preparation of the paper; Angle's "Malocclusion of Teeth," Talbot's "Irregularity of the Teeth," and Hawley's paper on "The Dental Arch" were used for reference.

I desire to acknowledge my indebtedness in the preparation of this paper to Mr. C. H. Alsberg, my associate in the preparation of the drawings; to Dr. Ralph Waldron, for advice; to Dr. R. Ottolengui, for interesting plaster casts for study and investigation; to Dr. E. W. Schumacher, for an excellent specimen of a skull with an almost perfect denture.

Malocclusion of teeth is the result of either external or internal disturbances, or of both, during the growth of the denture, which are more or less known to dentists and orthodontists. Teeth, like plants, etc., are products of nature, and must be treated as such. Plants grow with their roots toward the center of gravity of the earth, the stem and foliage in the opposite direction; but, by natural or artificial means, they can be forced to deviate from their natural direction of growth. By the elimination, counteraction, or stimulation of natural influences, the same results can be obtained in the treatment of malocclusion.

It is not my intention to write of a denture from the standpoint of a practicing physician or dentist, but, rather, to show how its construction may be scientifically investigated from the engineer's point of view.

The dental arches consist of a plurality of units, the teeth. These are located in adjacent positions in each arch, and the two arches are in such relation that they conform to certain geometric, mechanical and kinematic requirements.

The language of the engineer is that of the drawing board. The drawings are the words; points, lines, and symbols are the letters; descriptive geometry is its grammar.

It is only natural for an engineer to approach such a complicated structure, as the denture represents, by an investigation on his drawing board. The results obtained have been very satisfactory and have already been presented to the dental profession in various forms by me, as well as by those whom I have interested in looking at the denture from this scientific viewpoint.

By means of orthographic projection, an object may be most accurately and conveniently pictured on a plane. At least two projections are required to locate points of an object in space, though more than two projections will often be necessary to convey a clear representation of the object. We must know the position of its points in space. In a denture, we should represent points of interest of the teeth, such as the cusp, summits, contact points, and

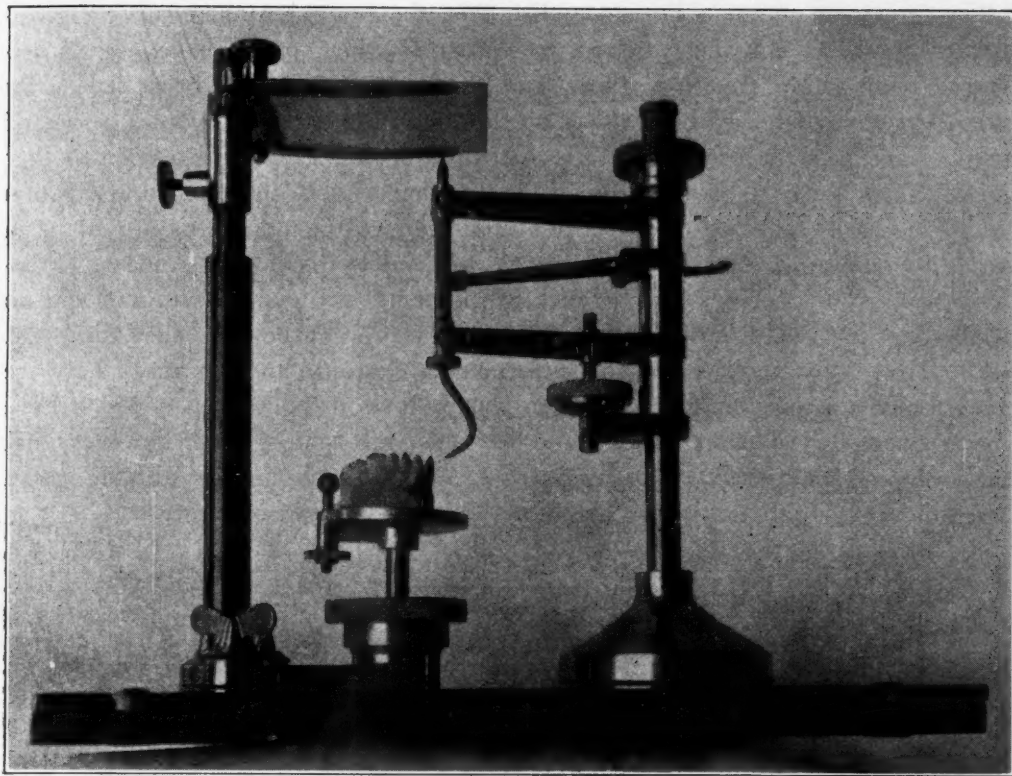


Fig. 1.

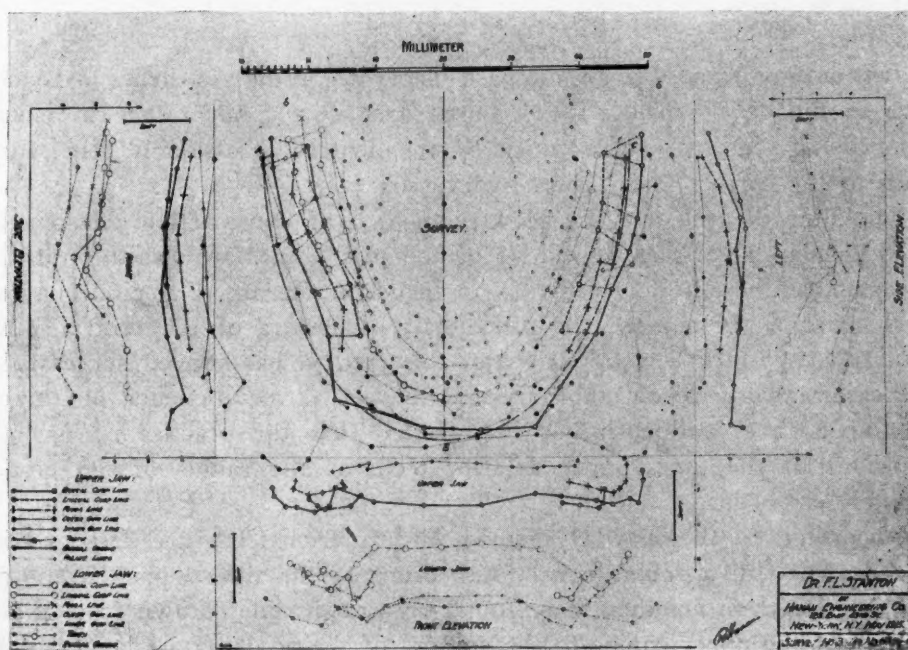


Fig. 2.

other prominent points. To accomplish this, the Stanton-Hanau surveying apparatus (Fig. 1) has been devised, by means of which points have been transferred orthographically to a plane, and their elevations have been read. By using various colored carbon papers on the recording sheet and copies, series of points have been differentiated (Fig. 2), then a pantograph (also some other methods) was used to enlarge the surveys so that a more thorough investigation could be made. I have used successfully a surveying apparatus for about a year; but, in the long run, the work has proved too tedious. Another drawback was due to the fact that the men in the dental profession, who had had no training in the reading of drawings, did not like the surveys because these did not readily convey to them the information desired, and because they are accustomed to representations of their plaster casts in photographs which have the advantage of showing every detail. It must not be forgotten, however, that the ordinary photograph is a perspective, and, as such, is not suitable for a scientific investigation of this problem.

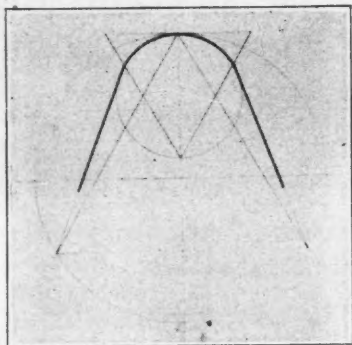


Fig. 3.

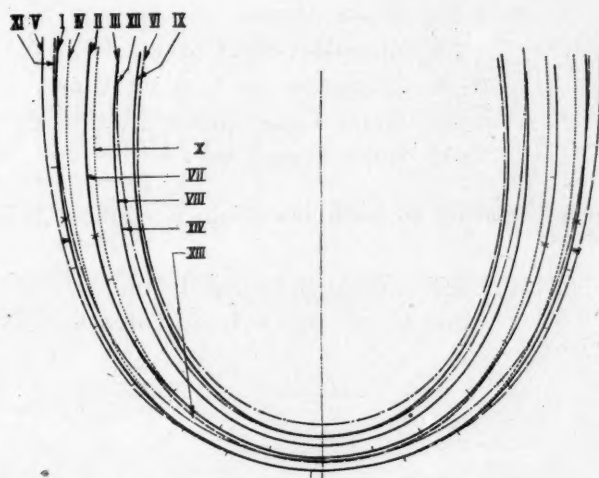
It is not my purpose to go into past history regarding the earlier and various stages in the development of the dental arch form; but rather to examine the merits of one arch form which by the dental profession is generally regarded as the correct form—the Hawley arch.

The Bonwill arch and the Hawley method of construction, illustrated in Fig. 3, which have long served in orthodontic work, are based on the assumption that the anterior teeth are arranged on the arc of a circle having a radius equal to the sum of the mesio-distal diameters of the central, lateral, and cuspid. Only in exceptional cases this method has proved successful; in some cases it very closely approximated the actual requirements, but in most cases, upon investigation, it has been found that the practice of using the dimensions of the three upper anterior teeth as the radius of the circle is absolutely erroneous.

According to the Hawley method, the anterior teeth are arranged in a circle drawn with a radius equal to the sum of the three upper front teeth. The posterior teeth are then to be found on straight lines drawn from the distal angle of the upper canine to the corners of the equilateral triangle. These lines form an angle of not quite 70° with the base of the equilateral triangle.

How this Bonwill or Hawley arch could so religiously be adhered to by the dental profession is not quite clear to the author. There is absolutely no reason why the form of all human dentures should converge upon one geometric figure, which would mean that in proportion the size of the individual teeth, as well as the size of the entire lower jaw, must increase or decrease in the same ratio as it does in the upper. It is well known that this is not the case; in fact, hardly any two dentures are found to be alike. Consequently there can not be one geometric figure to dominate the complex relations found in the denture.

In applying the Hawley arch, no attention has been given to the interrelation



DENTAL CURVES

| CURVES | UPPER | LOWER |
|---------------------------------|-------|-------|
| BUCCAL CUSP | I | VII |
| FOSSAE | II | VIII |
| LINGUAL CUSP | III | IX |
| COMPENSATING CONTACT | IV | X |
| OUTER GUM | V | XI |
| INNER GUM | VI | XII |
| | | |
| OUTER CURVE OF OCCLUSAL CONTACT | XIII | |
| INNER CURVE OF OCCLUSAL CONTACT | XIV | |

Fig. 4.

of the upper and lower anterior teeth, and likewise, the interrelation of the posterior teeth is neglected. The relation of the teeth of both upper and lower jaw in space, perpendicular to the plane of the arch, is not mentioned at all.

The different curves of the denture in their horizontal projection can best be seen in Fig. 4. All these curves are continuous in their course and represent curvatures very nearly coinciding with the corners of the respective lines connecting like points in one jaw.

UPPER JAW

- I. Buccal Cusp Curve
- II. Fossæ Curve
- III. Lingual Cusp Curve
- IV. Compensating Contact Curve
- V. Outer Gum Curve
- VI. Inner Gum Curve

LOWER JAW

- VII. Buccal Cusp Curve
- VIII. Fossæ Curve
- IX. Lingual Cusp Curve
- X. Compensating Contact Curve
- XI. Outer Gum Curve
- XII. Inner Gum Curve

Lines and curves relating to both jaws which connect points of occlusal contact are:

- XIII. Outer Curve of Occlusal Contact.
- XIV. Inner Curve of Occlusal Contact.

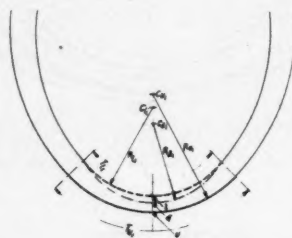


Fig. 5.

Some of these curves and their relations have previously been considered in a joint paper by Dr. F. L. Stanton and the author, presented before the Panama-Pacific Dental Congress in San Francisco during 1915. A more thorough investigation since has shown that while the observations published at that time were important steps in the development of dental surveying, they were neither complete nor were they based on unassailable hypotheses. Fig. 4 clearly illustrates the complex relation of the different dental curves in their horizontal projection.

In laying out the horizontal projection of these curves it was ever kept in mind that, aside from the tooth measurements proper, the relation of the curves in space must be considered. The projection plane very nearly runs through the contact points of the upper incisors, canines and premolars, i.e., the anterior part of the U.C.C.C.* The incisal portion of the L.C.C.C. is inclined toward the projecting plane; and in order to get correct results, this portion of the L.C.C.C. has been revolved into the plane of projection or into a plane

*For abbreviated terms see nomenclature, page 657.

parallel thereto. The dash-dotted circle with a radius, R_a , and a center, C_a , is the result. (See Fig. 5.)

This revolved arc of the L.C.C.C. may be designated as the actual arc of the lower anterior, and it is on this arc that we have to mark off the mesio-distal diameters of the lower, and not on the projection of the L.C.C.C. It has another very interesting feature; it very nearly coincides with the projection of the labial angle of the incisal edges of the lower centrals and laterals, the points of contact of the lower and upper incisors.

To facilitate the problem of laying out the teeth of the dental arch in their

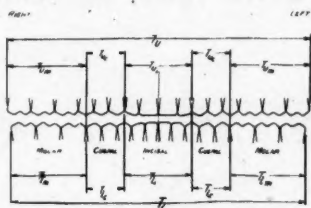


Fig. 6.

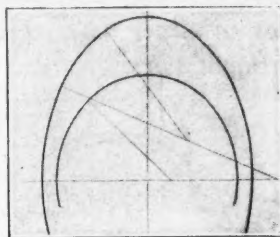


Fig. 7A.

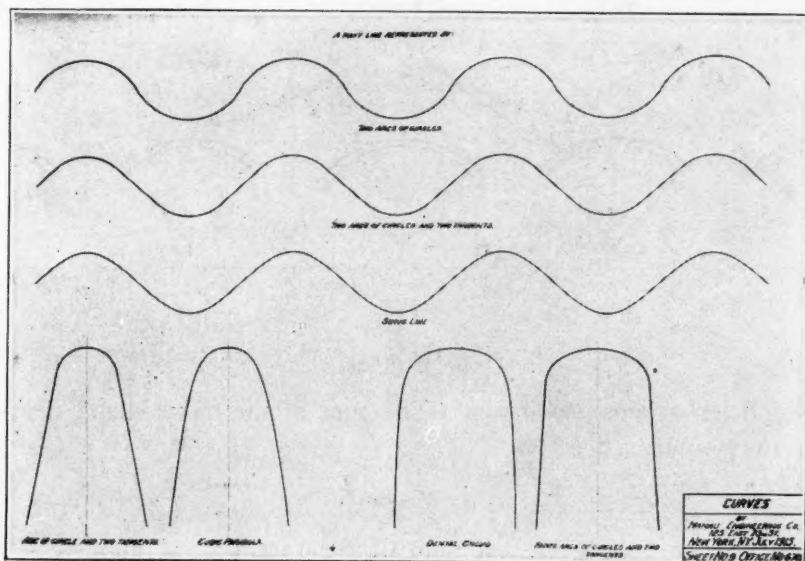


Fig. 7B.

proper relation, we have divided the denture into *five* distinct regions (Fig. 6):

I. The incisal region consisting of the centrals and laterals of the upper, and of the centrals and laterals and the mesial halves of the cuspids of the lower jaw.

II. The left cuspal region.

III. The right cuspal region.

Each consists of the canine, first premolar and the mesial half of the second premolar of the upper, also the distal half of the canine, and the first and second premolars of the lower jaw.

IV. The left molar region.

V. The right molar region.

Each embraces the distal half of the second premolar and first, second and third molars of the upper jaw, also the first, second and third molars of the lower jaw.

Each part of a C.C.C. in a region is represented by an arc of a circle, hence each C.C.C. is represented by five arcs of circles.

To substitute a curve by a series of arcs of circles is quite permissible, and does not affect the accuracy of the results nor does it mar its appearance. Fig. 7A shows two ellipses. The left of these ellipses is made up of arcs of circles, while the points of the right are most accurately laid out and connected by a continuous curve. There is hardly any difference to be detected between the continuity and the accuracy of either half. Fig. 7B shows several curves and substitution by arcs and straight lines.

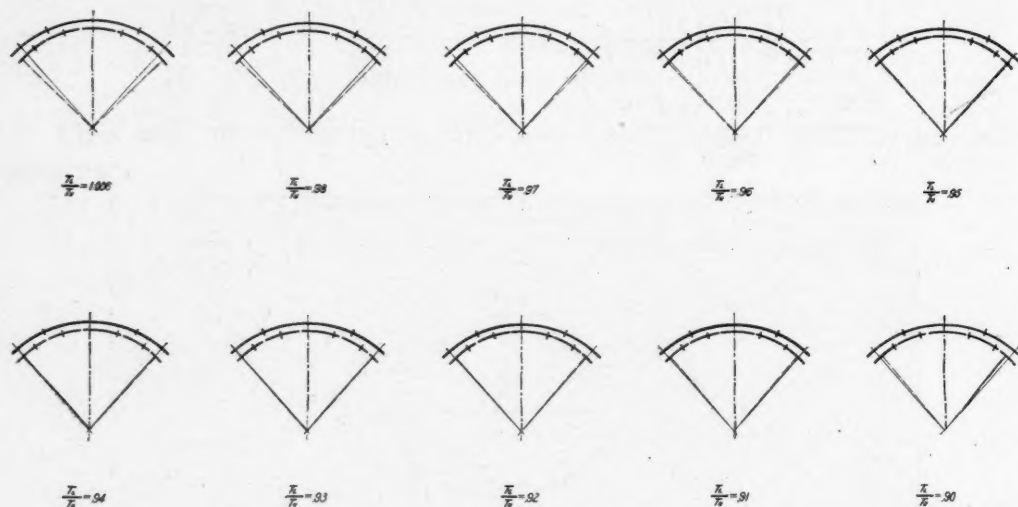


Fig. 8.

In Fig. 8 ten arches are shown. The sum of the mesio-distal diameters of the upper four anterior teeth

$$(2C_u + 2L_u) = T_{uj}$$

is considered a constant, while the sum of the mesio-distal diameters of the 2 centrals, the 2 laterals and the two half canines of the lower

$$(2C_l + 2L_l + E_l) = T_{li}$$

varies. The incisal ratio

$$\frac{2C_l + 2L_l + E_l}{2C_u + 2L_u} = \frac{T_{li}}{T_{uj}}$$

changes from 0.90 to 1.006.

The same arcs are used in all figures for laying out the tooth material for both the upper and lower incisors.

The figure having the ratio 0.93 shows the teeth in their proper occlusal relation; i.e., the teeth under consideration interdigitate in accordance with occlusal requirements.

Let us assume that the radius for the arc in this figure was selected according to the Hawley rule, and that incidentally it had proved correct, in so far as the placing of the tooth material on the arc is concerned. According to the Hawley rule there could be only one solution for the varying relations between upper and lower mesio-distal diameters which have incisal ratios ranging from 0.90 to 1.006. The teeth have been placed on the arcs in their adjacent position, but in juxtaposition in the upper and lower.

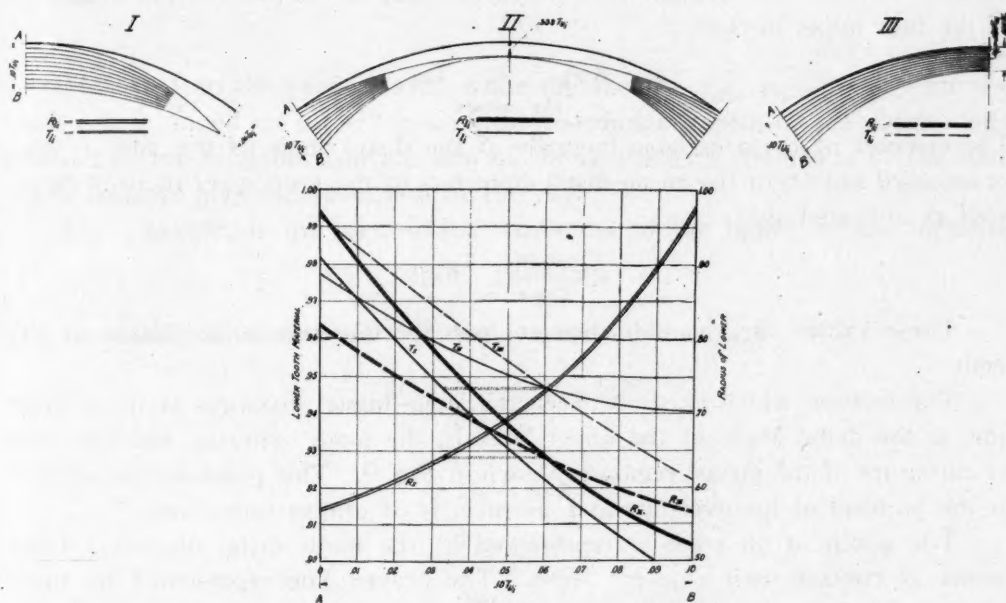


Fig. 9.

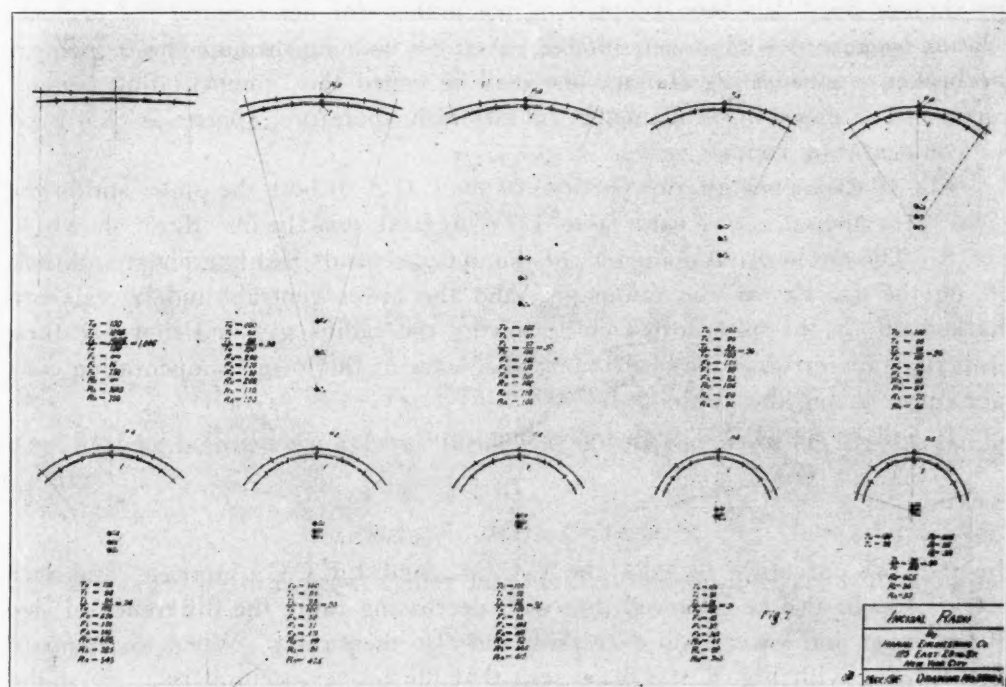


Fig. 10.

It will be observed that with the increasing ratio, the distal angles of the lower teeth are distally malposed, while in the figures where the ratio decreases, the distal angles of the teeth are mesially malposed. These figures clearly show that the Hawley thumb method is unreliable, being based on mere guess work.

In order to simplify the problem, measurements and surveys of normal dentures of the teeth have been made, and it has been found that at the apices of the arcs which represent the projections of the incisal portion of the C.C.C.'s the distance of the teeth normally is 0.045 of the sum of the mesio-distal diameters of the four upper incisors.

$$A_{m1} = 0.045 \quad T_{ui}$$

(An average)

The distance of the arcs labio-lingually at the distal angle of the laterals may be assumed as 0.06 of the mesio-distal diameters of the four upper incisors measured as indicated above; i.e.,

$$A_e = 0.06 \quad T_{ui}$$

(An average)

These values vary as they depend upon the dimensions and shape of the teeth.

The relation which exists between the labio-lingual distances at the median line, at the distal angle of the upper laterals, the tooth material, and the radii of curvature of the incisal region is shown in Fig. 9. This presents the solution of the problem of the over-bite and, as such, is of utmost importance.

The width of all teeth is represented by the mesio-distal diameters from points of contact with adjacent teeth. The broken line represented by these mesio-distal diameters throughout the entire denture, known as "the compensating contact line," has been adopted by the author for determining the occlusal relation because it is the most suitable. A curve running through the corners of the broken compensating contact line may be called the "compensating contact curve." The mesio-distal diameters of the teeth, therefore, appear as chords of the compensating contact curve.

Fig. 10 shows ten anterior portions of the C.C.C. of both the upper and lower jaws. The incisal ratios vary from 1.006 to 0.90, exactly like those shown in Fig. 8. The mesio-distal diameters of the upper centrals and laterals are marked off on the arc having the radius R_{ui} , and the lower centrals and laterals are marked off on the dash-dotted circle having the radius R_{ai} , and they are then properly transferred to the projections of the arc of the lower compensating contact curve having the radius R_{li} .

It will be noted that with increasing ratio

$$\frac{T_{li}}{T_{ui}}$$

the radii of curvature of both the U.C.C.C. and L.C.C.C., increase, and vice versa. It will also be observed that with decreasing ratio, the difference in size of the upper and lower radii decreases, and also their ratio. When we compare this drawing with Fig. 8, it will be seen that the proper occlusal relation of the anterior teeth, labio-lingually, is achieved.

The radii used for these layouts are taken from the chart shown in Fig. 11. This chart shows the incisal radii in their relation to the ratio

$$\frac{T_{li}}{T_{ui}}$$

It is the result of thorough nomographic investigation.

The ratio

$$\frac{T_{li}}{T_{ui}}$$

is represented on the vertical axis, while the factors, F_{ui} , F_{li} and F_{ai} , for the radii will be found on the abscissa of the coordinate system of the chart. The product of these factors and the sum of the mesio-distal diameters of the four upper incisors give the dimension of the radii.

For example, if the mesio-distal diameters of the upper incisor measure

$$2(8.9 + 7.0) = 31.8$$

and the mesio-distal diameters of the lower teeth measure

$$2(5.7 + 6) + 6.6 = 30.0$$

then we have

$$T_{li} = 30.0$$

$$T_{ui} = 31.8$$

$$\frac{T_{li}}{T_{ui}} = .943$$

Reading the chart we find that for the ratio .943 the radial factors are:

$$F_{ui} = .74$$

$$F_{li} = .62$$

$$F_{ai} = .58$$

therefore, the radii are:

$$R_{ui} = F_{ui} \times T_{ui} = .74 \times 31.8 = 23.53$$

$$R_{li} = F_{li} \times T_{ui} = .62 \times 31.8 = 19.72$$

$$R_{ai} = F_{ai} \times T_{ui} = .58 \times 31.8 = 18.44$$

The distance between the apex of the U.C.C.C. and the circle having the radius R_{ai} is:

$$.033T_{ui} = .033 \times 31.8 = 1.049$$

We begin by drawing a center line, and describing a circle with a radius

$$R_{ui} = 23.53$$

then we measure from the apex "u" centripetally

$$.033T_{ui} = 1.049$$

and mark this point "a" on the center line. Then we mark "l" on the center line at a distance of

$$.045T_{uj} = 1.43$$

from "u" on the U.C.C.C.

It would be accidental if we should find the continuation of these curves to be a straight line, posteriorly from the canines. With few exceptions the C.C. Curve is a true curve, therefore, it must be continuous and show no sudden changes or breaks. The posterior extensions of the dental arch frequently assume an asymptotic character.

The anterior portion of the denture being settled, it now remains to investigate the cuspal and molar regions of the denture. But the cuspal regions in particular deserve most careful attention. Any error in this part of the denture may affect the anterior, as well as the posterior teeth in their occlusal relation.

Let us see what would occur if we should make an error in the selection of

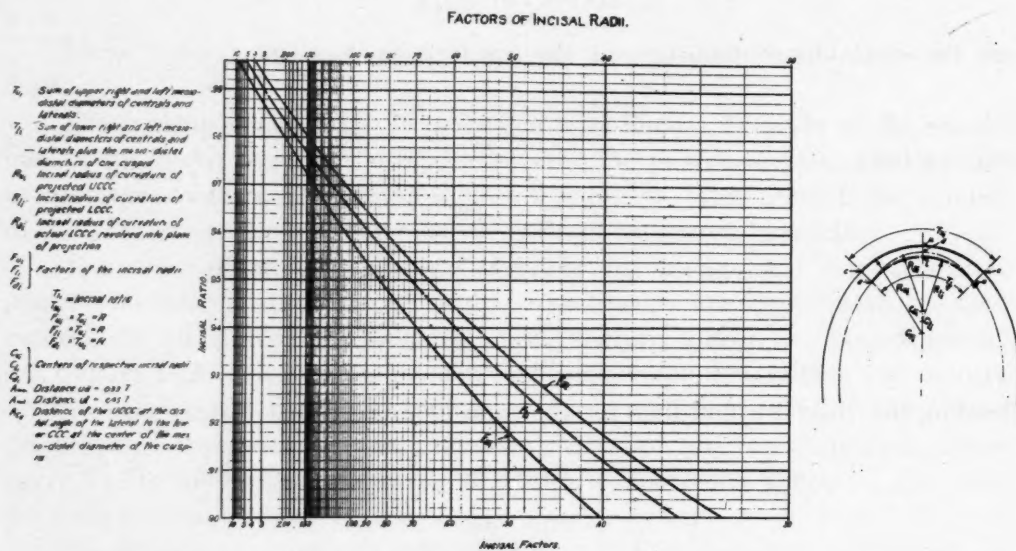


Fig. 11.

an incorrect radius for the curvature in the horizontal projection of the cuspal region.

Assuming that the selected *cuspal radius (of curvature)* is too small and the lower teeth in the position selected will still be able to hold their own, assuming also, that the incisal and the molar portions of the upper arch retain their occlusal relation, then a break of the arch in the cuspal region results. If for some other reason the incisal and cuspal portion of the upper will remain in occlusal or pseudo-occlusal relation, and the teeth of the upper molar portion remain in contact with the cuspal portion, then the result will be that the lower posterior teeth will be malposed.

For the purpose of illustration let us select the same incorrect arch, and assume that the lower molar and cuspal regions retain occlusal or semioclusal contact relation with the uppers, then a break of the upper arch occurs within

the upper incisal portion, provided the lower teeth remain in position. When selecting too big a radius, the reverse, as explained above, will take place.

The relation between the incisal cuspal and molar portions of the denture is so intimate that it must not be overlooked. Fig. 12 illustrates in a plane the result of selecting different curvatures for one and the same set of tooth units.

Accepting the incisal region as correct, let us assume that at one time the denture is of such a nature that the projections of the Upper and Lower C.C. Curves continue in circles of varying radii from the distal angle of the upper lateral and the summit of the cusps of the lower canine. At another time on the right half of the figure let us assume that the C.C.C.'s of the upper and lower

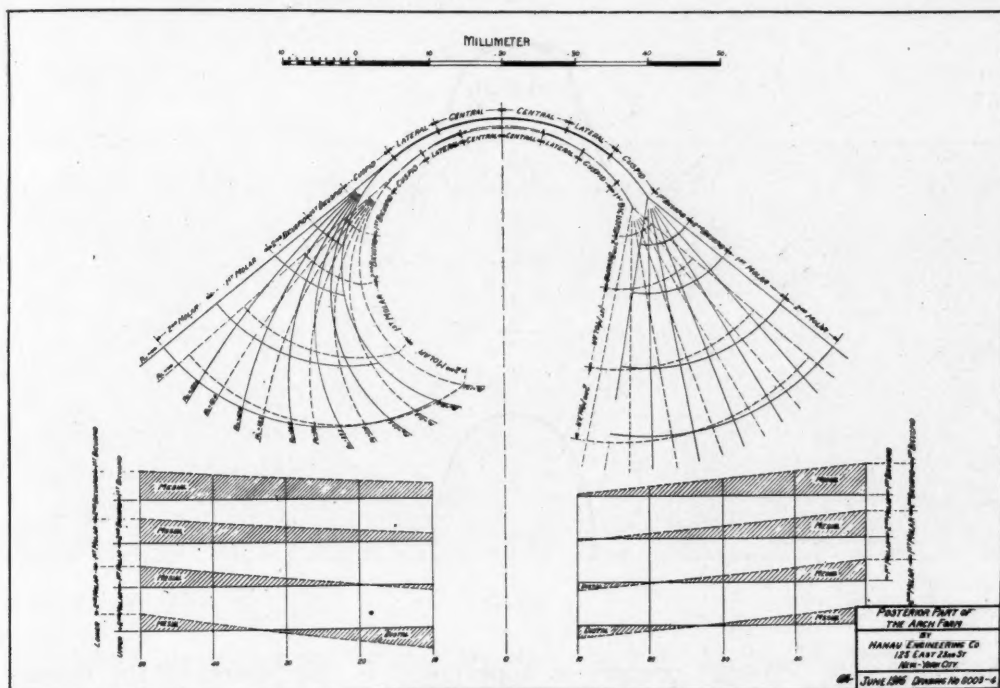


Fig. 12.

continue posteriorly from the distal angle of the upper canine and the center of the lower first premolar at different angles in straight lines. Below each half a diagram illustrates the changes which occur in the mesio-distal relation of the contact points. The bucco-lingual distances for each set of C.C. Curves are nearly constant. We may read the relation between adjacent contact points of the two jaws on verticals drawn from the distal contact points of the second molars on the diagram below. The radii change from an impossible minimum to an impossible maximum, and so do the angles of the lines on the right half of the figure.

A closer study of the figure convinces us that no one particular arch form can be adopted to be standardized for all dentures by merely providing a series of

sizes of geometrically alike figures, unless a fixed relation in the size of the individual teeth exists, which does not.

It would have been more in keeping with existing conditions if someone had introduced a shape of dental arch consisting of three arcs, one forming the apex or the anterior portion of the denture, and two extending posteriorly from the canine, having a common tangent at this point.

There is no question that such an arch form is more beautiful and resembles more closely the human arch form, and with a little pains and thought, a convenient construction thereof could be devised. Fig. 13 will sustain this claim. The Hawley arch form is shown along side with this for the purpose of comparison. Both arches possess some merit, but they are equally misleading, although the Hawley arch has almost universally been accepted as a standard.

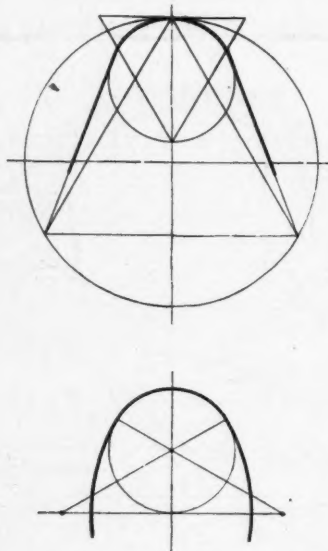


Fig. 13.

This new arch, although prettier in appearance, is not presented for serious consideration; it is solely a product of imagination.

Figs. 14, 15 and 16 represent the U.C.C.C. and L.C.C.C. in their different occlusal relations, direct occlusion, end to end bite, and lateral occlusion, each in three projections.

Other dental curves were likewise investigated and the results of these investigations were used to check up the accuracy of plotted dental arches.

It may be mentioned that the author, in the early stages of his investigation, found a general mathematical formula applicable to all dental curves of a denture in occlusion, but this is of theoretical value only.

$$y = F_1 (X^1 \pm y f(w))^n + C_1$$

$$z = F_2 y^n + C_2$$

x, y and z represent the ordinates in a coordinate system whose point of intersection is the apex of the U.C.C.C. The x-y plane is laid through the apex

of the U.C.C.C. and the contact points of second premolars and first molars, or better $\frac{1}{2}$ mm. below the latter. The y-z plane is vertical to the x-y plane and divides the dentures antero-posteriorly.

The factors, F_1 and F_2 express the relation of the units on the axes.

X^1 is the x ordinate of the parent parabola to which is added $y f(w)$ when x is positive, and subtracted when x is negative.

$f(w)$ itself invariably is negative for dentures in occlusion and mostly of simple form, in the figures $f(w) = \text{tg } d$.

With increase of $f(w)$ we approach the elliptical arch form, the exponent

$$1.5 < n_1 < 4$$

The lower values of "n" only occur together with high values of $f(w)$. The exponent "n" indicates a parabolic character.

$$n_2 > n_1$$

$$F_2 < F_1$$

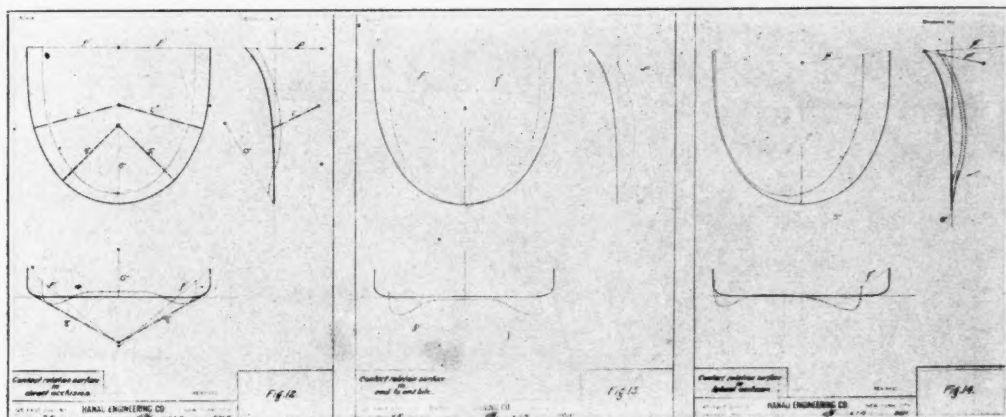


Fig. 14.

Fig. 15.

Fig. 16.

Curves illustrating the formula are shown in Figs. 17, 18, 19, 20, and 21.

In Fig. 17 is shown a series of curves representing the formula

$$y = F_1 (X^1 + y f(w))^n + C_1$$

in which

$$C_1 = 0$$

$$F_1 = 1$$

$$f(w) = 0$$

while the exponent "n" varies from 1 to 8.

It will be noted that the lower part of the curves flattens out and the side becomes steeper.

If these curves were to be observed in dentures, we would say that by increasing exponent "n," the incisal radius increases, the canines become more prominent, and the posterior extensions approach the parallel lines.

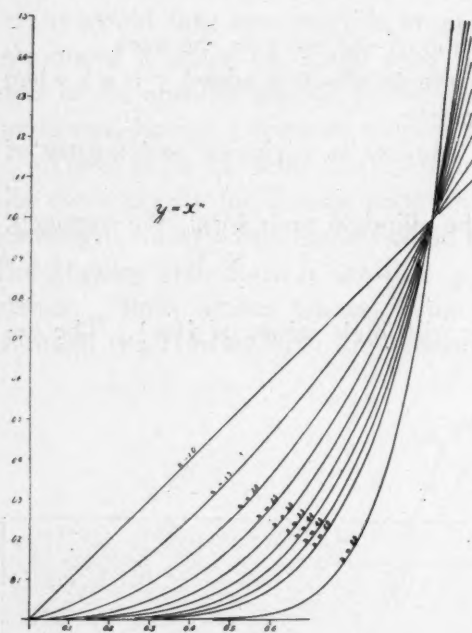


Fig. 17.

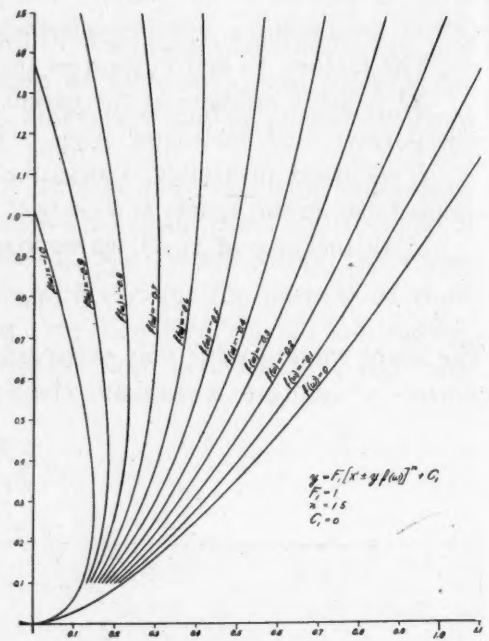


Fig. 18.

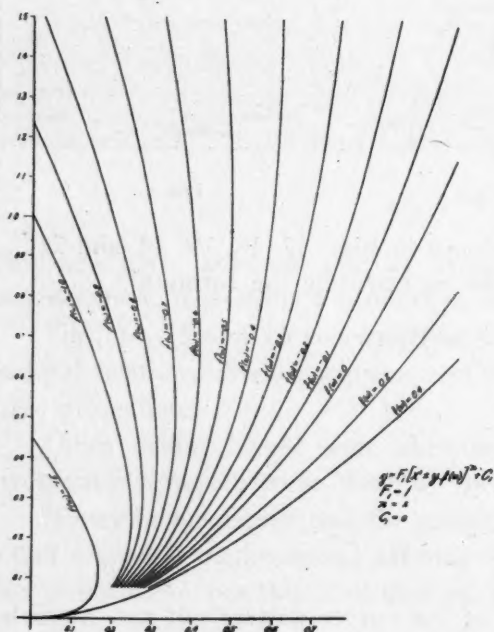


Fig. 19.

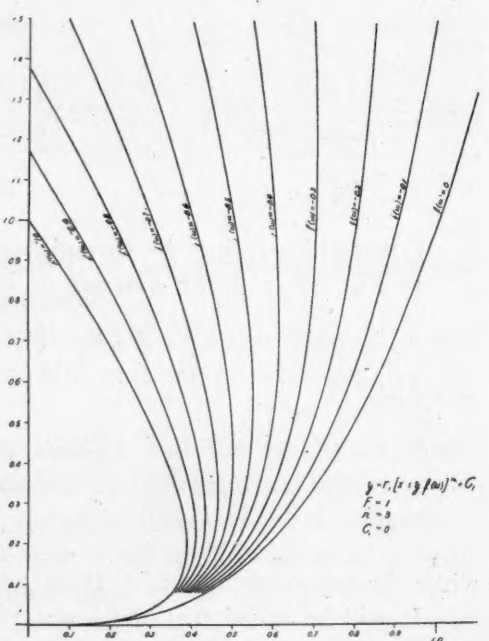


Fig. 20.

Figs. 18, 19, and 20 show curves, each for a different exponent. The different values for $f(w)$ and n , are indicated. Fig. 21 shows curves where the exponent

$$n=3$$

but the factor F_1 is subjected to variations. The resulting curves are geometrically similar.

Ordinarily, standardization is simple, if only one factor of the formula is subject to change; it would also be in order, if more than one factor changes, but in such cases a plurality of types must be considered, and each type should be standardized separately.

Fig. 22 is an enlarged view of a survey of a denture in malocclusion, the points were surveyed and their elevations read with the aid of the Stanton-Hanau surveying apparatus.

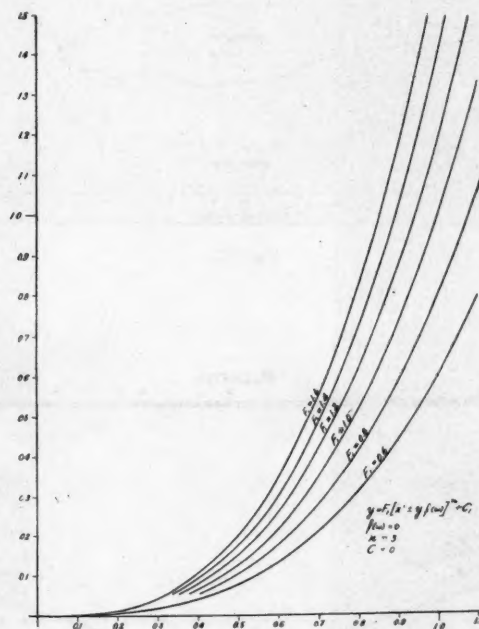


Fig. 21.

Fig. 23 shows the development of the points of the denture on a surface laid through an arbitrary arch, illustrated in Fig. 24.

In the paper read before the Panama-Pacific Congress at San Francisco in 1915, this subject was taken up.

Figs. 25A and 25B show a "photo-survey" of the same denture. By photo-survey is meant a photograph in orthographic projection. It has the advantage over the survey made on the surveying apparatus, in that it shows every detail, and, therefore, is more explanatory.

Another denture is illustrated in Figs. 26, 27, and 28 in horizontal projection and in side view. To make these photo-surveys, I designed a camera. The main feature of this camera is a peculiar combination of lenses.

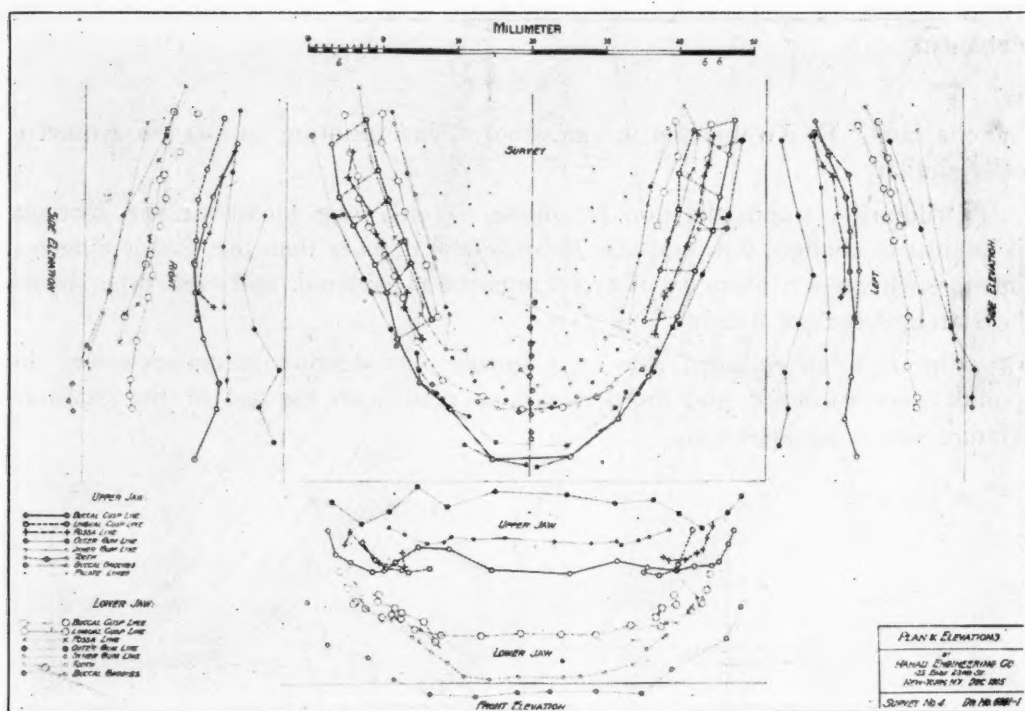


Fig. 22.

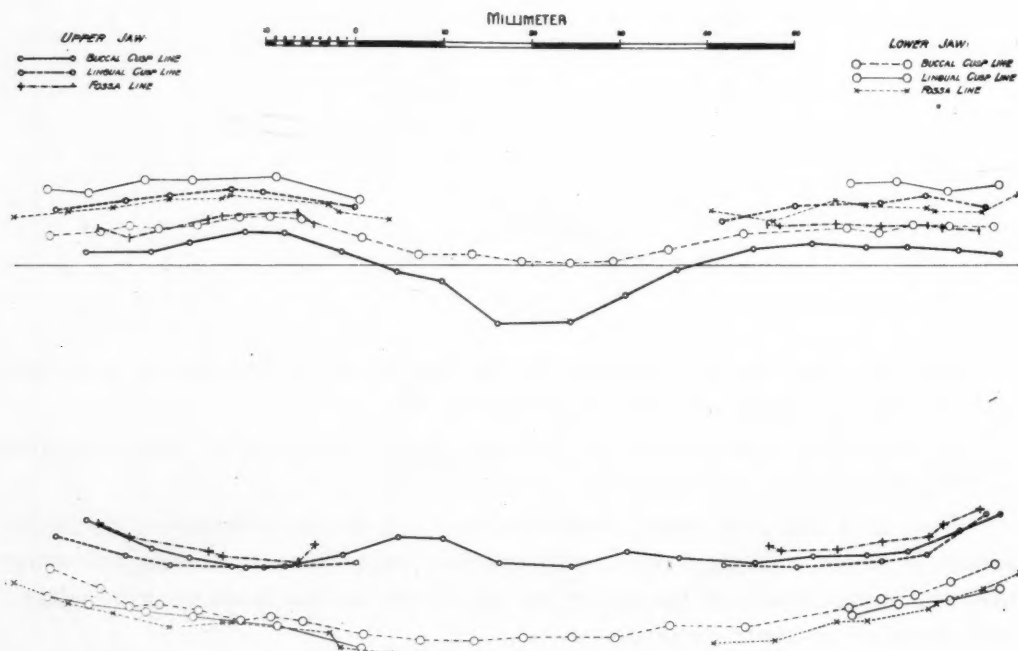


Fig. 23.

Figs. 29 and 30 show orthophotographs of a skull in both front and side views. The apparatus was not meant to take such large objects.

Fig. 31 brings before us the plan of the upper and lower denture.

The various dental curves were drawn on such a survey and were compared with Fig. 4. It proved that Fig. 4 was a good representation of the relation of the different dental curves.

The severe criticism here applied to arbitrary methods in the laying out of dental arches is not intended to belittle their originators or authors, but is designed to bring to the attention of the profession the elements of danger always connected with the application of arbitrary methods and thumb rules to scientific matters.

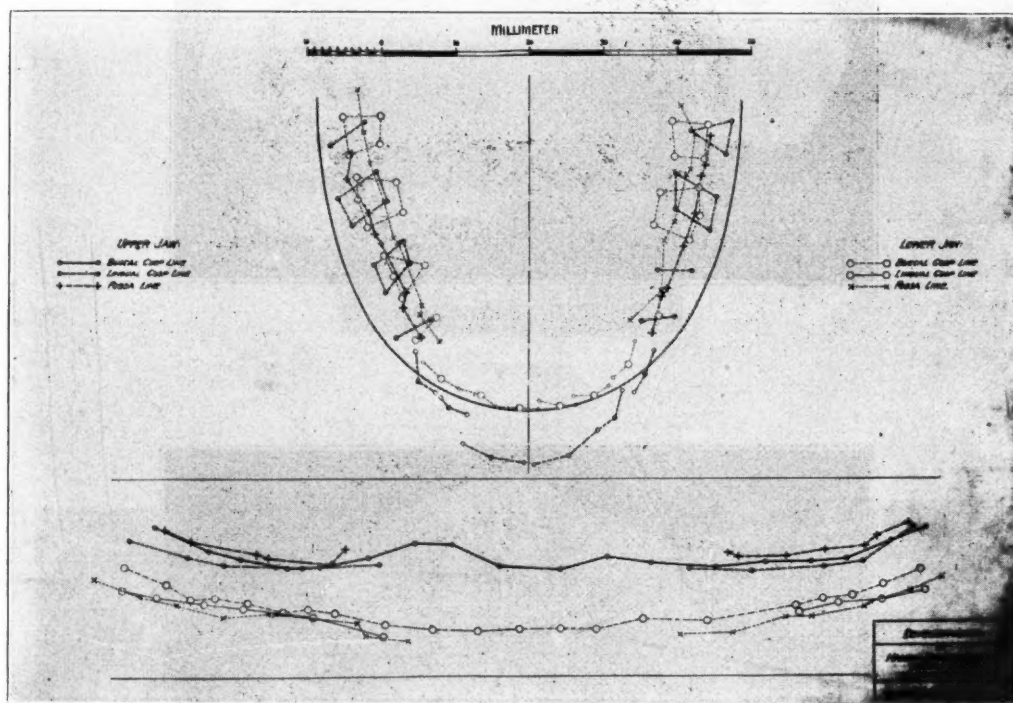


Fig. 24.

The author is aware of the existence in all scientific fields of similar evolutionary processes, inasmuch as all applied sciences are exposed, at the start, to tendencies to formulate observations of practical value into convenient and handy rules for the purpose of facilitating their application. At the same time we must ever consider that all such methods lead to approximate values, and their use can be justified only for the want of better, absolute methods.

"Thumb rules" have been, and still are, applied in all scientific fields; they were, in fact, the basis for construction in my own profession; they are, however, defensible and justifiable only if they lead to sufficiently accurate results.

Let us remember that in the laying out of the dental arch we have to deal with very small units, and that, therefore, an apparently negligible difference in

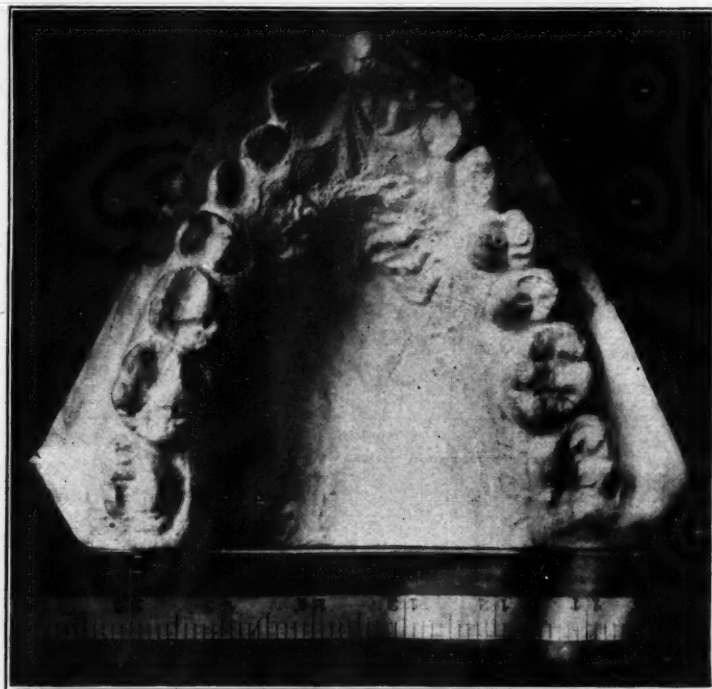


Fig. 25-A.



Fig. 25-B.

the dimensions will appreciably mislead us, and bring us to an utterly false conclusion.

Let us also consider that every individual case requires treatment absolutely peculiar to itself, for it will hardly occur in practice that two dentures are found exactly alike.

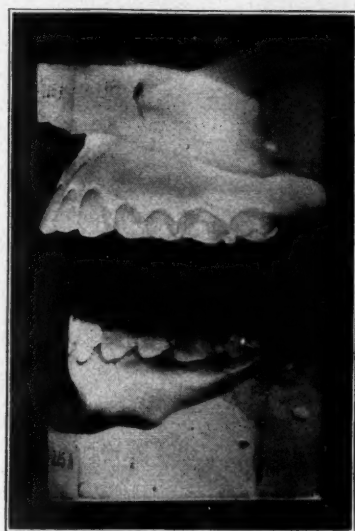


Fig. 26.

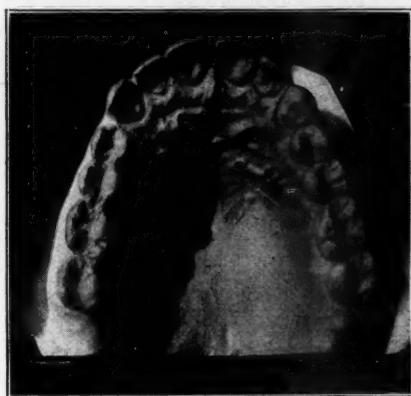


Fig. 27.



Fig. 28.

For these reasons it must be patent to all students of orthodontics that the application of arbitrary methods to a formation as complicated as the human denture should not only fail of recommendation, but ought also be discouraged, if not condemned.



Fig. 29.

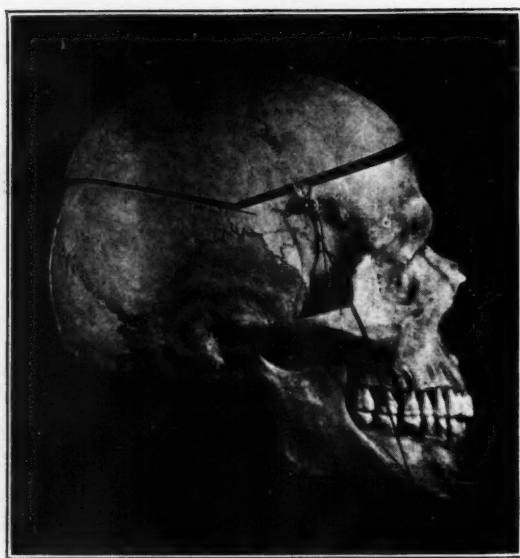


Fig. 30.

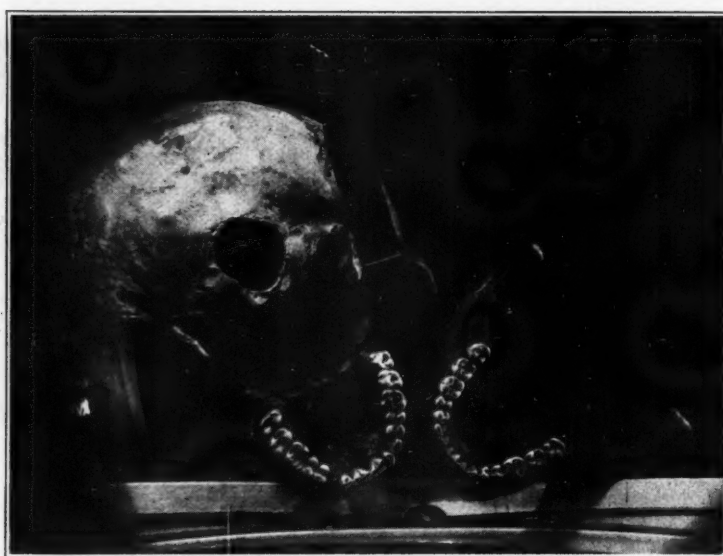


Fig. 31.

CODE

APPERTAINING TO THE MATHEMATICS OF THE DENTURE

| TOOTH | TEETH | |
|----------------------------|-----------------------------|-----------------------------|
| | UPPER | LOWER |
| Central | C _u | C _l |
| Lateral | L _u | L _l |
| Cuspid (or Canine) | E _u | E _l |
| 1st Bicuspid (or Premolar) | B _u | B _l ¹ |
| 2nd Bicuspid (or Premolar) | B _u ² | B _l ² |
| 1st Molar | M _u ¹ | M _l ¹ |
| 2nd Molar | M _u ² | M _l ² |
| 3rd Molar | M _u ³ | M _l ³ |

| TOOTH MATERIAL | | |
|----------------|-----|--|
| Upper | Tu | |
| Lower | Tl | |
| Upper Incisal | Tui | |
| Lower Incisal | Tli | |
| Upper Cuspal | Tuc | |
| Lower Cuspal | Tlc | |
| Upper Molar | Tum | |
| Lower Molar | Tlm | |

CURVES

| CURVE | UPPER | LOWER |
|---------------------------------|--------------|----------|
| Buccal Cusp | U.B.C.C. | L.B.C.C. |
| Fossae | U.F.C. | L.F.C. |
| Lingual Cusp | U.L.C.C. | L.L.C.C. |
| Compensating Contact | U.C.C.C. | L.C.C.C. |
| Outer Gum | U.O.G.C. | L.O.G.C. |
| Inner Gum | U.I.G.C. | L.I.G.C. |
| Outer Curve of Occlusal Contact | O.C. of O.C. | |
| Inner Curve of Occlusal Contact | I.C. of O.C. | |

RADII, CENTERS, AND FACTORS

| | INCISAL | | CUSPAL | | MOLAR | |
|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | UPPER | LOWER | UPPER | LOWER | UPPER | LOWER |
| Radius of Curvature | R _{ui} | R _{li} | R _{uc} | R _{lc} | R _{um} | R _{lm} |
| Centers for Radii | C _{ui} | C _{li} | C _{uc} | C _{lc} | C _{um} | C _{lm} |
| Radial Factors | F _{ui} | F _{li} | F _{uc} | F _{lc} | F _{um} | F _{lm} |

MISCELLANEOUS

| | | | |
|------------------------------------|-------|---|---|
| Center of Revolved Curvature | | | |
| Apex of U.C.C.C. | u | Distal Angle of Upper Laterals | c |
| Apex of L.C.C.C. | l | | |
| Apex of revolved lower incisal arc | a | Center of Mesio-distal Diameters of Lower Cuspids | e |
| Distance of C.C.C.'s at | El Ae | | |
| Distance u-a | Ama | | |
| Distance u-l | Aml | | |
| Distance c-e | Ace | | |

CONCLUSIONS

The dental arch form is a function of the tooth measurements (size and shape), of the relation of the teeth in each jaw, as well as in opposite jaws, and of the kinematic and mechanical requirements.

The graphic method is recommended for investigation and checking.

DISCUSSION

Dr. Kemple.—I am sure our essayist has made it very clear to everyone present here how he harmonizes the dental arches by careful mathematical computation of the amount of tooth material involved. I want to say in the very beginning, for the benefit of our essayist and also for our members, that this society is very much interested in the scientific side of this subject. We want to learn all we possibly can about predetermining the dental arches. If we can learn that, we will feel more than repaid for the trip to Pittsburgh, and some of our members have come great distances, from Washington, Oklahoma, etc.

We want this discussion to be carried along on perfectly scientific lines, and I am very glad to have an opportunity to ask Dr. Stanton to kindly open the discussion on this paper.

Dr. F. L. Stanton.—I think this is probably the most important paper ever presented before this society. When you, as orthodontists, realize that the occlusion of any individual tooth can be predetermined, and shown in relation to maps of the malocclusion, you will agree with me in regard to the importance of this subject.

At various times during the last two years I have endeavored to show several of the members of this society the necessity of considering the denture in three dimensions, and am glad to see Mr. Hanau has so successfully held your attention. He, as an engineer, has done conscientious work.

I will outline my connection with this work. In the fall of 1914 I was so displeased with orthodontia in general, and myself in particular, that I decided that unless I could place the whole matter on the drawing board and see what I needed to do, I would abandon orthodontia. From October, 1914, until the spring of 1915, I made maps of models of malocclusion by means of calipers and bisecting lines. Maps were made of dentures in the various types of skulls at the National Museum and at our Museum at New York. In the spring of 1915, seeing the necessity of considering the third dimension, and desiring to have an instrument constructed that would record the relative heights of the denture, I consulted engineers and selected the essayist, who constructed the dental surveying apparatus. From the data I had collected, the essayist devised the mathematical predetermination of the arch as related in the San Francisco paper.

In the fall of 1915, being desirous of having the work checked to date, I consulted the engineering department of Columbia. In two weeks I received an indorsement, saying it was correct to make maps of malocclusion, but a much simpler method of predetermining the occlusion mechanically was devised by Mr. Gilbert D. Fish, which method I shall demonstrate at my clinic tomorrow. A paper has already been prepared describing this method.

I am sure what you have heard tonight will change the practice of every man in

this room and childhood will be better served the world over as a result of this paper. I thank you all.

Dr. Hawley.—Mr. President and Gentlemen: I have listened to this paper with much pleasure; but it would have given us more pleasure if some parts of the paper had been read, because Mr. Hanau did not read all the criticisms made of my arch. I do not know if the reason is that I have become acquainted with him since he wrote it, and he does not want to hurt my feelings! My feelings would not have been hurt because all the defects of that arch he has named I have admitted again and again publicly. The situation relative to those arches, and what I comprehended of this paper, is this: In the first place, when those were drawn there was a very little accurate comprehension of the size of the dental arch; i.e., the positions in which the teeth would be, and I attempted from the measurement of the teeth to produce a Bonwill arch. The arches produced and placed on the chart were Bonwill arches, and they were accompanied with the general criticism of those arches, which I stated were true. Mr. Hanau has criticized them. They did not represent the exact position of the teeth in the mouth, because the molars were always lingual from the straight line backward of the cuspid; but they did give a fairly accurate conception of the width of the arches corresponding to size of the teeth. The conception I had gained previous to this, and which was common to most orthodontists, was that it was possible to make a perfect occlusion of the teeth if one had sufficient skill. In other words, that the tooth material in the upper and lower jaws was harmonious and constant. You get that taken out of your mind after you measure teeth awhile. As soon as I began to draw arches of the upper and lower teeth and tried to fit them together, I saw it was a mistake and that was admitted in my second paper and advised against, and the whole matter of the use of that arch is simply an approximation.

Now there was a lack of harmony in the upper and lower arches and that was caused by the inharmonious amount of tooth material in the upper and lower arches, and this is most common in the incisal region. This problem I have never been able to work out.

As I can see Mr. Hanau's paper, he has worked out the relation of tooth material in the upper and lower teeth so that you know the exact situation, and I do not question at all his results. There is no one who views his work with more pleasure than I do, and no one that accepts more freely than I his criticisms on these arches.

Now the question comes up in my mind, and probably in yours, just how practical this is and just how much will it modify our work. Dr. Stanton is enthusiastic, and is of the belief this will revolutionize the practice of orthodontia. I am not so enthusiastic about that. It will solve a problem that has not been solved before. Mr. Hanau is an engineer and he admits that he does not know very much about orthodontics nor has he experience in the kinematics of orthodontics. I stated to him the problem of the relation of the two lines formed by the measurement of the tooth material in the upper and lower arch, and he agrees with me. If we accept the arches he draws, and accept them with the interpretation that Dr. Stanton makes, we might have an amount of tooth material that would make our curve almost a straight line. Suppose I would give him the measurements of the teeth in a certain type of patient; for instance, a type of head which is long and narrow and a face long and thin, and he would tell me the tooth material in that face, or the relation between the amounts of tooth material in the upper and lower jaws was going to indicate a very wide, flat arch in the anterior region: I would tell him I would not do it, but that would be just as valuable to me because he would indicate to me what I could and what I could not do. That is, suppose I say, from the type of the individual and what I conceive to be an artistic result, what will conform to the anatomy and type of the head,—I want to produce a certain arch. He will tell me exactly how much tooth material I must sacrifice in every arch. If he would tell me to widen the upper teeth and make spaces between them, I would say I would not do it, possibly, but he could tell me, on the other hand, that possibly I would have to reduce the tooth substance in the lower jaw and I might decide to do it. So while there are things which will modify it in practice, the arches which he would indicate to me are possible for normal occlusion. I might say I could not do that in that case; but he has solved a problem I could not solve, and I am especially pleased with the manner in which he presents it to this society. His attitude is that of an engineer: our attitude is that of the working orthodontist, and we may arrive at different conclusions. So far as revolutionizing our practice is concerned, you are going, in the use of these arches, to meet exactly the same problem I did in guessing at arches. When I had all the tooth material, I could measure them and arrive at the

proper measurement; but, in 75 per cent of the cases we treat, we do not have all the tooth material. We do not get the canines until 12 years of age, etc. We must treat cases before that age and we have to depend on an *accurate cast*. So far as being able in all cases to absolutely predetermine the arch, I do not see how we are going to do that, and we are left in 75 per cent of cases very nearly where we were before. I do not mean to detract from the value of this work, but to clearly distinguish the situation and the problem he has solved. I have found some cases, and some have been brought me where, so far as we could measure and determine and lay out, it was impossible to get the occlusion of the molar and premolar teeth without producing an under-bite. There was too much tooth material in the lower arch or jaw. In some of those cases I have extracted the lower incisor and produced a normal over-bite and normal occlusion of the molar teeth. That was not my former conception of the harmony in the human denture, but I feel certain it is absolutely true. Mr. Hanau can make an absolute survey with this process, of the conditions there, and have something definite on which to base work in practice, and in that way especially it is extremely valuable.

It seems to me there are some things here proposed that may be indicated in the formation of the curve of the mouth that may be difficult and impracticable to produce, but I would like to try it even yet. I feel greatly indebted to Mr. Hanau and am very much pleased at his presentation of the subject.

Dr. Ottolengui.—I would like to ask Mr. Hanau a question. I thought we were going to have explained to us a method of predetermining the arch form, and I have listened with much interest and think I have understood a little of it, but all I can get so far is the predetermination of the arch form in the anterior region. The question I want to ask is: "Have you worked out a solution of the whole arch form?" It seems to me this is rather a fragmentary presentation.

Mr. Hanau.—I have worked out a method for the entire arch form.

Dr. Ottolengui.—You showed on the screen some orthodontic projections of models of mine that I had loaned to Dr. Stanton, and you did not present any arch forms for that case. When you spoke of missing tooth substance, I thought you were talking of that case because that is the only case I remember about, and in that case apparently the lateral and cuspid on one side are considerably smaller in diameter than the lateral and cuspid on the other side, for which, if I remember correctly, Dr. Stanton suggested it would be necessary to have the median line a little bit off. Another point not very clear is, it seems to me you have not given us any formula for really making the arch form nor shown any predetermined arch forms that you have, and you have not made it clear to me and neither did Dr. Stanton. I want to say on behalf of Dr. Stanton, I think he very patiently undertook to instruct me in this matter, notwithstanding I advised him I thought I would be a very poor pupil and I do not believe I ever did grasp what Dr. Stanton tried to teach me and I do not grasp it now and I must make a *foolish* (?) statement when I say that in none of this work, as I understand it, do I see anything about the occlusal plane. It does seem to me that Dr. Stanton said if we understood it we would not attempt to elevate the teeth; and I believe that is one of the most important factors in the retention of the teeth,—to get the correct occlusal plane. That is as important as to get the correct arch form. I must confess my inability to grasp that part of it in either your paper or in anything Dr. Stanton has told me.

Mr. Hanau.—The relation of the teeth in the molar and canine regions is similar. Only the contact relation surface has a different pitch, while in the front the compensating contact surface has an incline antero-posteriorly, on the sides it has an inclination linguobuccally. So if we apply the same method (the ratio of lower tooth material to the upper tooth material) it can be charted out according to the same principle.

Dr. Young.—I have listened to this paper of our essayist with a great deal of interest and a great deal of pleasure also, and the point that strikes me in regard to this question is its real practical value to the orthodontist. I am convinced, after going over Mr. Hanau's paper several times, that he has proved very conclusively that owing to the variation of tooth material in the incisal region of the lower and upper that the dental arch will vary in its width. In other words, if the lower tooth material in the incisal region is brought in further to get those teeth into occlusion, we must have a wide dental arch in the anterior region. If, on the other hand, the lower tooth material is narrow in its relation to the upper, then the dental arch should be considerably narrower. That is where Dr. Hawley's scheme seems to be decidedly at fault; because, as Dr. Hawley

has said for a good long time, there was not a constant relation of tooth material in the lower and upper dental arch; so he simply took the upper to serve as a guide to make the arch from that. Dr. Hawley has made a statement tonight about not being able to establish normal occlusion, owing to too much tooth material in the lower. I would like to ask Dr. Cryer, who has had much experience in examining skulls, if he has ever run across a skull with normal occlusion of the teeth in the premolar and molar region, with the incisors absolutely end to end, striking one on top of the other?

Dr. Cryer.—I think I have, and believe I can produce skulls in which bicuspid, or premolars, are in typical occlusion with the incisors, meeting edge to edge similar to the incisors of the dog.

Dr. Young.—That was the point. I remember two cases before I really knew what the occlusion of the teeth was, where the patients seemed to have beautiful occlusion of the molars and premolars and the incisors were end to end and worn perfectly flat; I believe that is normal occlusion for that type of individual, and I think it a mistake to extract incisor teeth for that individual to establish an over-bite in the incisor region.

I would like to ask Mr. Hanau a few questions. Given a set of models with all the teeth except the third molars in eruption, would you be able from your tooth measurements and your mathematical calculations to determine the exact amount of over-bite that should be established in that particular case?

Mr. Hanau.—If I understand the question, you have a certain amount of tooth material in the anterior part of the denture. Are we able to determine the exact over-bite necessary for that particular case? I have to make an assumption, if the lingual parts of the upper teeth are not of such formation that they clearly indicate where the edges of the lower should strike the lingual surfaces of the upper, but if those points are pronounced, I naturally have the solution, provided the tooth material is in harmony. I also have to consider the proper occlusal relation of the lower on the upper surfaces. If you can give me any law for the correct occlusal relation of those teeth, then I will give you the exact curve which is required to bring those teeth within the law which you, as an orthodontist, have given me. Can you give me a law or rule?

Dr. Young.—I can not. Here is the next question. As Dr. Hawley says, in 75 per cent of cases we have not the premolars nor methods to measure from. I may have four incisors and four first molars. It is practically unnecessary to ask that question, because if you could not do it in the previous case with all the tooth material to measure from, you can not in this.

* * * * *

Dr. Young.—Gentlemen: The most important part Mr. Hanau has brought out in this paper tonight is what he calls orthophotography. It seems to me if he can develop a lens (and I do not see why he can not) that we can take these photographs in such a way that we absolutely eliminate the necessity of surveying models and not only will that be of interest where we want to determine what shaped dental arch we are to establish, but in all our illustrations in publishing papers. I was much impressed with these orthophotographs. As I said, I can not see the very great value with Dr. Stanton, that we will get out of this work, inasmuch as we have to do so much assuming in treating so many of our cases with mixed dentures.

Dr. Lischer.—I shall begin by asking Mr. Hanau a question. Assuming that you can make an accurate survey of the dental arch, I would like to know whether it can be made of a deciduous denture, of a permanent denture, and of a mixed denture?

Mr. Hanau.—Of all of them.

Dr. Lischer.—Very well. Now, if we make such a survey, will it reveal any facts as to the relation of the dental arches to other anatomic landmarks of the skull?

Mr. Hanau.—That is very important also.

Dr. Lischer.—Now suppose you could accurately determine that relation at the early age of, say, eight years, we are still confronted by the fact that this relation *changes constantly during the period of growth*. I happen to remember that several years ago Angle read a paper before this society in which he claimed the mesio-distal position of the upper first permanent molar was a fixed one, and I also remember that his hypothesis was not only violently attacked by numerous writers, both here and abroad, but at the Fiftieth Anniversary Meeting of The Austrian Dental Society (November 14, 1911), Dr. Otto Zsigmondy, of Vienna, read a paper *On the Growth of the Upper Jaw* in which he presented two very beautiful plates showing the occlusal view of the upper dental arch

in six skulls of various ages which definitely disproved Angle's contention. In each skull he drew a sharp line from a definite point on one zygomatic arch to a similar point on the opposite zygomatic arch. In the youngest specimen this line fell between the first and second deciduous molars. In the next, the second deciduous molar is shown half way to the mesial of this line. In Fig. 6 the line falls between the second deciduous molar and the first permanent molar. In Fig. 8 the dental arch has so far moved forward that the line falls between the first and second permanent molars.

In view of such tremendous changes, due to growth, what is the use of predetermining an arch for a patient of seven or eight years, but who will be under treatment and observation until twelve or fourteen years? And during all that time his denture is changing its relation constantly to other anatomic landmarks of the skull; and that relation must concern us if we become so ultraaccurate.

Don't misunderstand me; I don't want to undervalue certain mathematical methods and their possible application to lesions of the human body. I think Mr. Hanau's efforts in this direction merit our highest praise and admiration. He has delved into his tasks with a thoroughness and enthusiasm which few men possess. Besides, in optics, for instance, such researches may prove of the highest value. But I am still unconvinced as to the practical application of the results he has so far achieved, especially if we keep in mind the changing relations to which I have referred.

Mr. Hanau.—I can answer that only in part. You change your glasses constantly due to the hardening of the lenses of the eye. It is due to a physical change, and by physical means is corrected. You say you assume a line. If you permit me to assume any line then you give me a basis from which I can reckon, and if you say you want to know the relation of the growth or the relation of all the changes which have occurred in those years, to that line, that is the easiest thing in the world; because you will have this result: After six years, this tooth is here; after seven, here; after eight, here. So we can put up lines of travel under which the teeth have changed their position with relation to this line. I might as well measure everything from the center of the earth. That would be more correct, as the sea-level is not always the same distance from the center of the earth.

Dr. Lischer.—Anthropologists have agreed on a number of very definite points on the cranium of man, but it is difficult, if not impossible, to find a fixed point on the head of a growing child. But even if we could, what is the use of such a survey if the dental arches continually change their anatomic relations during the period of growth?

Mr. Hanau.—Say for instance we keep the relation of the front part of the denture and the inclination of the denture to a plane. If you can determine that plane or assume it (and men who dwell in that line of science are satisfied with locating it) I am satisfied that we can locate the apex of the denture. I could then show the relation of all the teeth in their relative position, in their line of travel. We could determine the relation between the apex of the denture and your plane. That can be done.

It was never my intention to bring nature into mathematical lines, but to accommodate mathematical problems to nature. I look for some formula that will picture nature as correctly as possible. Nature when not disturbed works best on mathematical lines.

Dr. Federspiel.—According to your ideas you can measure this by a two foot rule. You attempt to predetermine an arch when you have malformed teeth, as in rickets.

Mr. Hanau.—I do not care whether you put bricks there or teeth, I will give you a formation which will take care of these units. If the units are malformed, the resultant will be malformed. Should you follow the lines of good judgment and not the lines of nature? I call judgment guess work if it has no scientific foundation, but if we honestly say where we guess, it provides a basis for further work.

Dr. Stanton.—The gentlemen are not dealing quite fairly with the engineer and he is using the word "guess" and does not mean it. I am very familiar with Mr. Hanau's work. He means that, given an individual with teeth susceptible of occlusion, he can predetermine the arch. If there are teeth such as peg incisors, etc., he can not predetermine it because the arch is not susceptible of being put in occlusion. As to the temporary denture, no matter how it travels in relation to the skull, the moment you tell him what the normal occlusion is for that age he will predetermine the arch if the teeth are susceptible of occlusion.

Dr. Federspiel.—Where we have malformations of the jaws, as in micro- or a macro-mandibular curvature, how would you establish the correct occlusion?

Dr. Stanton.—The problem that the engineer solves is: given a set of teeth in malocclusion, it is possible to predetermine the form and dimensions of the normal dental arch. If you had a patient come to you at fifteen years of age, with normal occlusion and you made impressions, and then at 20 years he returned with a pronounced malocclusion, Mr. Hanau could give you the form of the arch you took at 15 when the patient had normal occlusion, by using the models of malocclusion.

Dr. McCauley.—Under the conditions mentioned, a denture susceptible of normal occlusion, Dr. Stanton states the engineer can predetermine the positions of these teeth. Can he predetermine the tooth curve and over-bite by mathematical means?

Dr. Stanton.—I can.

Dr. McCauley.—Can you without knowing the condyle path?

Dr. Stanton.—I can.

Mr. Hanau.—If your predetermined arch does not fulfill those requirements in the relation to the skull, then your predetermined arch is incorrect. You must then consider means to lay out a different arch. You can place different sized tooth material into the same arch form.

Dr. Kemple.—I believe the point Mr. Hanau wishes to establish is this, that given two amounts of tooth material, a certain amount for the upper, and a certain amount for the lower dental arch, no difference how much it is, it is possible for him to form through mathematical calculation, two curves which will harmonize. I just want to say a word on this subject myself. I have no doubt as an engineering proposition it is perfectly possible if these teeth were set in putty or in some medium in which you could move them to any position you wished them to occupy; but those teeth, gentlemen, can not be moved in any direction at will. Just one incident that will explain my meaning more clearly. I was going over this subject one afternoon with Dr. Stanton and he handed me a set of models and asked me to give him a diagnosis of that malocclusion. It was such a set as I would heartily diagnose as subdivision of Class II, in which the molars, according to my way of diagnosing the condition, together with the premolars of the right side, were in practically normal mesio-distal relation. They must have been normal in relation to some given point of the skull, but the upper and lower premolars were in normal mesio-distal relation. I told Dr. Stanton, in answering, what I would do in that case; that I would do so and so with the teeth on the left side. As to the right side I did not know I would do anything with it particularly. I thought I would not disturb it much. He asked in what direction that lower first permanent molar should be moved. I said I did not believe it should be moved at all. He said, "All right." He said that lower first permanent molar should be moved distally its full diameter. I said, "All right, let us see what is the full diameter of this lower first molar." We measured it, and as I remember, it measured 8 mm. or more. I said, "All right. According to your chart, and according to this method of predetermining that arch, in order to place those teeth in normal occlusion, you must move that lower first molar distally its full diameter,—more than 8 mm." The second molar was fully erupted. I said, "Dr. Stanton, if your charts show that those lower molars should be moved distally their full diameter, I would not give fifteen cents a carload for the machine that kind of normal occlusion, because God Almighty himself could not move those teeth distally." That was my feeling in the matter. I have that feeling, gentlemen, I can not help it. I spent two or three hours with Dr. Stanton one evening going over this question. I have read Dr. Hawley's paper and have gone over the drawings, and am frank to admit I can not understand the intricate mathematics of the question. I have listened with considerable interest to this paper, and the more I hear of it, the more I fail to see there is one iota of practical value to the orthodontist in it. I do not see how it will simplify our treatment one iota or benefit the orthodontist in the slightest. If by charting these arches in malocclusion we are asked to do impossible things, what is the use? It is an interesting mechanical problem and all that, but what is the use? That is my feeling in the matter.

Dr. Bogue.—I do not know but Dr. Kemple and Dr. Lischer have answered the very question I have wanted to ask. I do not understand English very well myself, and therefore I do not know quite what is meant by the "predetermination of the arches." A determination of the arches I understand. A predetermination means a determination beforehand. A determination beforehand of what? What the arches are, or what they are going to be, or what they can possibly be made by some power outside? May I ask those questions?

Mr. Hanau.—I was fully expecting that in some way I would be misunderstood. Your president has brought out the point in which I knew I would be misunderstood. I do not want you to go into mathematics. I want you to know what you are doing, and some of you do not know. I mean so far as the shape of the denture is concerned. From almost every one of those gentlemen with whom I have had the honor to speak, I have learned there was much I did not know, and every time I had a conversation with one of the gentlemen I found something new. I have learned tonight from the questions which have been asked me. The only object of my paper is not to press mathematical formulæ on your minds or let some genius make rules to impress those formulæ. You should know what geometric relation exists between the individual teeth of each individual jaw and of both jaws, and if you understand that relation perfectly you will be able to make such changes as are necessary, and you won't apply guess work. That is actually what is being done! "I will get the canine a little further out and see if it fits." But if you know beforehand, that if you move the canine buccally, such and such conditions will occur, you will be able to analyze what you are going to do before you do it and not wait until you get results you did not expect. The results may sometimes be caused by ignorance. If you know the interrelation of the teeth, I do not see how you, with your knowledge of orthodontia, would not go many steps higher in your profession. You must have the understanding for it. *That is the object.*

Dr. Bogue.—Our friend Carl Case was here yesterday. We happened to run across the same patient. The patient came to me first. I was absent and she went to Dr. Case. He took hold of the case and very admirably corrected the malocclusion. Out of interest in the mathematics or mechanics of the case I set to work to see what teeth needed moving, and how few teeth did need moving and in what direction they needed moving to accomplish the results, and my results on the plaster models were such that I moved only four teeth in the lower jaw and I think eight in the upper; and, by the way, I did not undertake to move any upper teeth backward! My young friend, Dr. Cryer, has taught me better than that! Neither did I undertake to move any lower teeth backward! But I did move these plaster teeth buccally on one side below, and above—never mind where: where I saw fit! By moving these few teeth, I got admirable results on the plaster models. I will send a duplicate model on to Dr. Case that he and I may compare the methods that we used. He got results on the patient.

The reason I brought this case up was this! Dr. Stanton invited me to his house one night. I found he was mathematically (with this same gentleman I presume) working out that very selfsame idea. Now comes the other question, of Dr. Lischer, of what was going to occur, and he asked I think, of Mr. Hanau, whether he could predetermine from the arches containing a mixed denture, what was to come later; whether he meant what was to come by keeping your hands off or whether he meant what was possible if we took the proper steps, I do not know.

Dr. Lischer.—Either way. It would not make any difference.

Dr. Bogue.—It would make considerable difference I think. If predetermination of the denture shows it is coming all right, we do not want to touch it, but if it shows us the material is there out of which the arch may be built and it is not coming right, then we would like to know that. But I found that the exceptions to normality were sufficient to offset the relations which might be mathematically calculated. I find, for instance, in certain physical conditions, instead of having ordinary laterals we will have a peg, and so I failed to understand both what Dr. Lischer asked and what he implied in his question, and I want enlightenment.

Mr. Hanau.—I might mention one thing more. I will show you the orthophotographs. If the relation of those lines and the tooth movements are fully understood, so far as the mechanics are concerned, there is no question but that this work should be an aid to you. I have applied pretty severe criticism, especially to the work of Dr. Hawley. I did not do that to belittle his efforts. I am most thankful to him because his paper really was the paper which woke me up. I did not know anything of orthodontia before, and after reading his paper I saw there was something wrong. I became interested in it, and I taught it to the men, so far as the engineering part is concerned. Dr. Stanton had some other gentlemen very much interested in it and I thank those gentlemen for listening to me: Doctors Ferris, Murrless, Crosby and others. They have listened to me and were instructed by me and they have given me many new thoughts by their questions and their answers. I want to warn you not to use any rules of thumb unless you know the principle involved, and unless you

know what will be the consequences of the plan laid down. If I have accomplished that, and if I succeed in interesting you gentlemen and have your aid in carrying on this work along the lines suggested by Dr. Lischer (there will be an end to it unless there are results), I will be well pleased. I thank you.

Dr. Kemple.—I am sure this has been a most interesting evening and I am going to entertain a motion that the society express to Mr. Hanau its unanimous thanks for the trouble he has taken to come here and give us this paper: and also to Dr. Stanton for coming out here and opening the discussion on the paper and giving you a demonstration tomorrow.

A CASE FROM THE PRACTICE OF DR. HAWLEY, SHOWING INHARMONY IN SIZES OF UPPER AND LOWER INCISORS

BY MARTIN DEWEY, D.D.S., M.D., CHICAGO, ILL.

WITH the advance of the science of orthodontia and the study of the teeth along the recognized line of practice in the consideration of normal occlusion, it is found that desirable results may be obtained in all types of mal-occlusion. While it is possible to obtain normal occlusion in the majority of cases, it has been found in late years that there are certain conditions which render the establishment of normal occlusion from the standpoint of greatest efficiency not always possible.

So far as we know, the first case to be reported in which there was a discrepancy or difference in the size of the upper and lower teeth to such an ex-

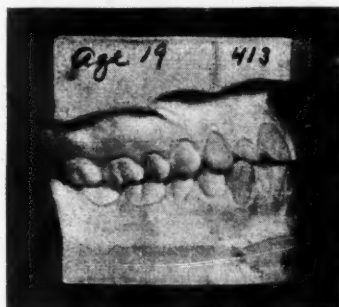


Fig. 1.

tent that it rendered the establishment of normal occlusion impossible is the case reported by Hawley which is shown in this article. The case may be briefly described as one in which the lower incisors were of such size as to be out of proportion when compared to the size of the upper incisors. As the results of this disproportion in size it was practically impossible to establish a normal occlusion, with a sufficient over-bite. By examining Fig. 1 it will be seen that the molars and premolars possess a normal relationship.

Fig. 2 shows a front view of the case, which, if carefully studied, will probably suggest that something is wrong, owing to the fact that there is such a decided bunching of the lower incisors and comparatively little bunching of the upper incisors, or what amounts almost to a protrusion.

Fig. 4 shows the occlusal view of the case before treatment. Fig. 3 shows the occlusal view of the lower arch. As the result of careful measurements and study of the teeth made by Hawley he decided that it was impossible to maintain a normal mesio-distal relation of the arches in the molar and premolar region and have a proper over-bite in the incisor region. We realize that the question of over-bite in the incisor region has been and is yet more or less of a disputed point, and what would be considered as a normal over-bite by one

Fig. 2.



Fig. 3.

Fig. 4.



Fig. 5.

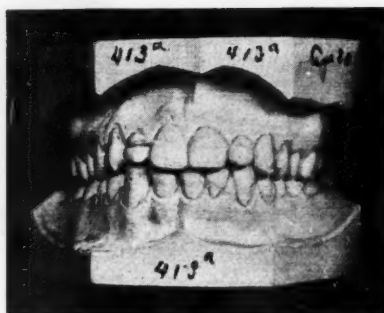


Fig. 6.

operator might not be so considered by another. However, by careful consideration of his case, Hawley decided that one lower incisor would have to be extracted in order to obtain an over-bite in the incisor region that would anywhere nearly perform a normal function. The result of this treatment is shown in Fig. 5, which is a side view of the case. Fig. 6 shows a front view with the missing, or extracted, lower incisor. It will be seen that one lower incisor occludes exactly between the upper centrals, or that the three remaining lower incisors occupy a relative position to the upper incisor that is usually occupied by the four lower incisor teeth. Fig. 7 shows the case after treatment. Fig. 8

shows the occlusal view of the lower arch after treatment, with the three incisors properly placed between the lower canines.

We remember when this case was first called to our attention, or first reported, that Hawley was more or less criticized for his treatment, and his judgment in the case was more or less a question. After the advent of dental engineering, the original set of models was sent to Rudolph L. Hanau for a dental survey. As the result of the dental survey Hanau concluded that the only possible way of getting a satisfactory occlusion from an engineering standpoint was to sacrifice one of the lower incisors. From an engineering standpoint this was done theoretically and the upper and lower arch reconstructed according to the plans of dental engineering with the lower incisor missing, and it will be seen that the shape of the lower arch and upper arch as sketched by Hanau from an engineering standpoint is practically the same as the result obtained by



Fig. 7.

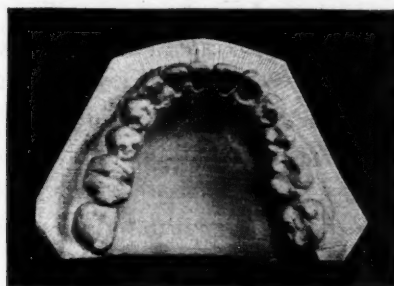


Fig. 8.

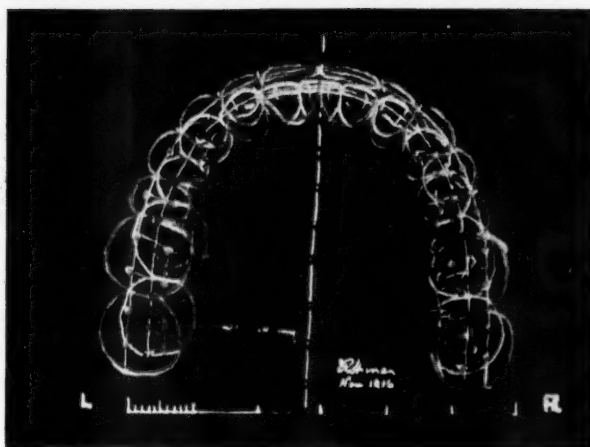


Fig. 9.

Hawley in practical treatment. By examining Fig. 6 and Fig. 9 it will be seen that the position of the lower incisor as regards the upper central is exactly the same in the finished result as it is in the diagram. Dental engineering, then, proves that from the standpoint of mastication and efficiency the treatment as outlined and followed by Hawley was correct.

Etiologic factors responsible for the inharmonious size of the upper and lower teeth are something which will have to be considered later, but nevertheless it is a fact which does exist, and because of its existence we have deemed it advisable that the case be reported at this time.

TEACHING OF ORTHODONTICS FROM THE STANDPOINT OF THE STUDENT*

By WILLIAM C. FISHER, D.D.S., NEW YORK CITY

WHEN the chairman of the committee in charge of the program for this meeting asked me to present a paper, giving me the above title, I refused, stating that I considered the subject could be treated only by someone who possessed a qualification that I, as a student, did not possess; namely, a diploma from one of the known private schools. This deficiency, he very promptly informed me, did not disqualify. He thus dismissed my other exemption claims as fast as I could present them, and so I at last found myself a conscript. Indeed, if our government has any great difficulty in handling the exemption excuses of its conscripts, I can heartily recommend to it the services of the chairman of your Board of Censors.

Of a volunteer we demand *duty* plus *valor*, while of the conscript we demand *duty* only. So be kind enough to bear this in mind.

That there is something radically wrong with the present facilities, if not methods of teaching orthodontics today, nearly every student of this specialty is quite willing to admit.

I do not possess, therefore, I can not offer a solution of the entire problem, but I hope I may be able to stimulate here a discussion that will assist in outlining a workable plan that will ultimately solve this very important matter.

Orthodontia has been recognized as a specialty now for a good number of years—ten, perhaps twenty, years. That today the young graduate either knows little more, or else is little more interested in it than the graduates of ten or fifteen years ago, and that during that period, it has been necessary for him to attend private schools, for special instruction, is proof sufficient that there is something wrong with the present teaching of orthodontics.

And the further fact, that many so-called specialists, graduates of these private schools, often have as their only qualifications, an additional amount of knowledge of the methods necessary to this special work; but without that broad view of the general practitioner, is additional evidence of a fault somewhere in both the orthodontic and dental curriculums.

Success in orthodontia means successful correction of malocclusions, which in itself demands a full understanding of normal or ideal occlusion, together with much other knowledge.

Why are not general practitioners impressed with this important knowledge as are the orthodontists from private schools?

With a clear knowledge of occlusion and the importance of the preservation of the mesio-distal diameter of the teeth, especially of the deciduous molars, how many, many cases of malocclusion, could be prevented and later orthodontic interference be practically unnecessary.

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 7, 1917.

Plea is often made that a busy general practitioner can not spare the time needed for orthodontic work. This is a wrong idea and should not be considered a just excuse any more than you would excuse a general practitioner for the same reasons, from performing any other character of mechanical construction. And many of us lose sight of the fact, that in small communities, the general practitioner is compelled to care for every character of dental work. His responsibilities in regard to orthodontia are just the same as to exodontia, minor oral surgery, prosthodontia, etc. Have we trained him to properly meet that responsibility? If not, wherein have we failed?

Just as the privately owned and controlled dental schools are almost a thing of the past, and our students may now receive instruction in dental departments of well regulated and high standard universities, so must the privately owned and controlled orthodontic schools, surely give way to well standardized postgraduate schools, under the control and supervision of our leading universities throughout the country.

Further: If these postgraduate courses are held, as they naturally would be under any such plan, in or near our large cities, and were made to cover two years of six months each instead of two months, and the hours of instruction so arranged, that they would not compel a man to devote more than four half days per week, more men could then avail themselves of such instruction and still conduct their practices. Another very great advantage would be (which is absolutely impossible in the present eight week private school courses) that a student could see the progress of the methods in practical treatment of clinical cases, and often bring these cases in a two year course to a somewhat satisfactory conclusion.

Still another advantage to be obtained by the establishment of postgraduate schools of orthodontia, and their proper standardization, would be, *ipso facto*, the standardization of the term "Orthodontic Specialist;" which term now any dentist may appropriate at will.

Not that I would for one minute be understood that I would not allow a general practitioner to practice the specialty; on the contrary, I think more general practitioners should be encouraged to take up the practice of orthodontia, along with their other work. That is what good postgraduate courses should accomplish. If he so wishes, and finds himself well qualified to do the work successfully, and particularly loves it, you may find him dropping his general practice and devoting his whole time to orthodontia. That is, if he is in a community that can support him in the practice of a specialty.

We find among general practitioners many who apparently have no desire to inform themselves about orthodontia. Would this condition exist *now* if the teaching of orthodontics in our dental schools had received its proper direction, during the past ten or fifteen years? I most emphatically do not think so.

Therefore, if the course in orthodontia in our dental schools be made of sufficient importance, we shall in the future find the graduates more interested in this special work and more capable of practicing the same and more desirous of increasing their knowledge by attendance on the postgraduate schools. And the postgraduate schools, conducted on liberal and large lines, will serve the double purpose of correcting the aforementioned apathy of the general practitioner and

furnish the opportunity of the interested, improving and perfecting their natural desire for specialized work. And further, there will result, what I believe, is the greatest of all good: That is by the interest in orthodontia that will be stimulated, and the high degree of mechanical ability, that will be developed; there will obtain a higher idealism and ability throughout the entire professional field. Remember that the profession will advance only in proportion with the advancement of its educational institutions.

We are extremely fortunate in having today in every large city one or more men of recognized ability in the specialty of orthodontia, who could, and I am sure would, serve on the teaching staff of such postgraduate schools. In particular cases they might well be organized, before affiliation with some university, but I want to emphasize the fact that only with that end in view are we justified at the present date in organizing what might be understood as quasiprivate institutions.

It would, of course, be better, could the original organization be made under the direction and control of a university with a dental department; thereby availing ourselves of the aid of collateral teachers and research workers, and also draw from their unusual abundant clinical facilities.

Another much desired condition, and this can apply to both the teaching of orthodontics in the regular courses, as well as the postgraduate courses, is a standardization of this subject, for every section of the country, so that, just as good specialists can be developed in the West as the South, and in the South, as in the East.

Like all great advances in scientific and educational work, mistakes will be made; severe adverse criticism will be heard; but these should not discourage, but rather stimulate, a greater effort to bring about an almost satisfactory, if not ideal, curriculum.

DISCUSSION

Dr. Martin Dewey, Chicago.—Mr. President and Members of the American Society of Orthodontists: The question of teaching orthodontics from the standpoint of a dental student requires a great deal of consideration, and it is something that may be approached from a great many angles. As the essayist took up the consideration of teaching orthodontics in the dental schools, we have a condition existing there which some of you are aware of, and in calling attention to this condition it refutes to a certain extent the argument made by the essayist regarding the establishment of postgraduate schools in universities. In the first place, the majority of large universities have no orthodontic department in their dental schools. An institution that does not recognize orthodontia in the ordinary dental curriculum of sufficient importance to have a professor of orthodontics is certainly not an institution to have charge of postgraduate instruction. That is one of the first difficulties we have to contend with. We have the condition of orthodontics being taught in some of the dental schools by the department of prosthesis. They have no separate orthodontic department. Then again we find undergraduate students are handicapped because correlated subjects are not properly taught. In the chair of dental anatomy should be taught occlusion of the teeth. That is done in very few schools. The chair of histology should teach the relation of dental tissues in regard to tooth movement. That is not done. In the chair of anatomy and physiology should be taught such things as are related to anatomic conditions found in malocclusion. That is not done. In other words, the student who leaves a dental college has to receive instruction in a great many things before he is qualified to receive proper orthodontic instruction. That is one of the first things we have to consider from the standpoint of teaching orthodontics. Now, we realize that orthodontics as taught the average dental student is not sufficient to qualify him to correct malocclusions, but is the dental student to be pitied as such any more than the medical student who leaves a

medical college without being qualified to practice surgery before taking a postgraduate course in a hospital, or serving an apprenticeship with a surgeon? Is the medical graduate qualified to make bacteriologic diagnosis in a pathologic laboratory before taking a special course in pathology and bacteriology? In other words, is the instruction received in orthodontics any more deficient than the instruction received in a great many branches in medicine? Can you expect a dental college to make a finished orthodontist out of every dental graduate? You certainly can not. You can not expect medical colleges to turn out finished pathologists and finished specialists qualified to practice the specialties of diseases of the eye, nose, and throat.

I have already called attention to the fact that there seems to be in the minds of some people an idea that the solution of every educational problem is to affiliate orthodontics with some large university. We hear men talk about the superiority of dental schools connected with universities. If you are interested in this subject, examine the reports of state boards and you will find the largest percentage of failures comes from the dental departments of universities. That is proved by reference to the reports of the National Association of Dental Examiners. The privately owned institutions, which are always looked upon as being insufficient, have a higher percentage of graduates pass the state boards all over the country than do the universities. That can be proved by referring to the reports of state boards. It is a fact that the graduates of certain universities have fallen down in their examinations before state boards. I have been told, that one institution contemplates resigning from the National Association of Dental Faculties because its university dental students have 50 per cent of failures. Are we willing to have orthodontics taught in such schools when students can be better prepared by taking private postgraduate courses? I do not think we are.

I have had some experience, as you know, in regard to privately owned dental schools; I have had experience with the medical and dental departments of universities and experience in postgraduate dental schools. I have been approached at various times to establish a department of orthodontia in two large universities. At one time I almost perfected plans to that end, but finally we got to the point of perfecting the proposition whether the university wanted to assume absolute control, which you may say is all right, but what assurance did I have that they knew how to run a postgraduate school? In other words, they would assume everything, and I was to work on a certain definite salary and not say what should be taught. That I refused to do. We do not claim that the type of postgraduate dental schools is perfect. Nothing is perfect, but we do believe a better postgraduate school can be conducted under the control of one man, who has devoted time and thought in giving the course, than can be given by the dean of a dental school who has absolutely no knowledge of postgraduate instruction in orthodontics.

Now, the question of a six months' course or a two years' course has been mentioned by the essayist. If you will stop and consider dental colleges and the discussions they have had with regard to a three and four years' course, you will find they have had great trouble in raising the curriculum. Now you want to insist on dental students taking four years of dental college instruction, and two years of postgraduate instruction in orthodontia, so that by the time a man gets through with his professional course he is ready for the old folks' home. You can not expect a man to spend two years more after he has gone through his dental course to complete his postgraduate course. How many of you will do it? Those of you who have criticized short courses have taken short courses, and some of you say that now we should make the courses longer. To be honest with yourselves, how many of you could leave your practices for two years to take a postgraduate course? This thing must be practical, as well as efficient, and I do not believe it is practical at the present time to give a postgraduate course of two years because you would be limiting it to a certain few. The man who can leave his practice and undertake a two years' postgraduate course would be the man who had an unlimited amount of money, and he would acquire the habit of going to school. The best student is the fellow who has to put himself through school, who sends himself to school; and the fellow who could spend two years in taking an orthodontic course would be the fellow who was sent to school.

The need of orthodontic work today is imperative. There are a great many malocclusions to be treated, and you can render people a greater service by arranging courses that are practical, that is, of sufficient length of time that a man can leave his practice and take these courses, than you will by carrying out the Utopian idea of having a two or one year's course. You must remember that this thing must be put on a practical basis.

The statement has been made that a man who goes out of a dental college and specializes immediately is not as efficient as the one who develops more mature judgment. My experience has been that the men just graduated from college make better orthodontists than those who have been out several years.

The standard of orthodontic instruction is an important factor. As I said this morning, and the committee on education will bear me out, I was instrumental in asking for the appointment of such a committee. We realize that orthodontic instruction must be standardized. We realized at that time there would be in the course of a few years a number of postgraduate schools devoted to the teaching of orthodontics, especially if one school seemed to be successful. The key to success is imitation. If any school succeeds in getting a number of students, and seems to be successful, somebody will try the same thing. The American Medical Association has worked for the standardization of medical colleges for years; and the American Society of Orthodontists should control postgraduate orthodontic schools, and it should go further and have something to say in regard to what course an orthodontist should be taught in dental schools, but we should try to make this thing practical, and not work upon the proposition that because two years' course seems to be Utopian, it is the only thing that can be given.

The question has been brought up as to what constitutes an orthodontic specialty. That probably will never be satisfactorily answered. Some have advocated a special examination by state boards for those men who are going to be specialists in orthodontics, but the average state board does not know much about orthodontics or the man who is going to be a specialist in orthodontics. The question has been raised that the man who specializes in orthodontics may not be able to pass a general examination of the dental board in other subjects. There is some room for both sides of the argument, but I think it would be much better to require a man who specializes in orthodontics to pass an examination in the entire dental field than it would be to license him on his ability to practice orthodontics. In the medical profession, if a man wants to practice surgery, he has to stand an examination on medical subjects. The dental profession has succeeded in certain states in getting what is called reciprocity, that is, if you register in one state you can register in another, if you do the practical work. Reciprocity from the standpoint of the orthodontist is an absolute joke because he has to go in and do certain things which he has not done for years—make gold crowns and plates, etc. In other words, he is examined in subjects he does not intend to practice. The state board says that we do not license you to practice orthodontics; we have licensed you as a dentist, and (if we give a special examination) you may then turn around and do general dentistry. From a legal standpoint, he who poses as an orthodontist can be held to greater account than one who does not pose as a specialist. The man who poses as a surgeon expects to obtain a better result from an operation than a general practitioner. The man who poses as a rhinologist must achieve better results than a general practitioner of medicine. The specialist is expected to get results beyond the average, but I am sorry to say that a whole lot of our results are not beyond the average, so that question will probably be one which will not be settled for some time to come.

The essayist also mentioned the fact that postgraduate instruction in orthodontics would be valuable to general practitioners of dentistry. That unquestionably is true, but if you go back to the old proposition, no matter how valuable such a course is to the general practitioner, the thing must be given in such a manner that he can take it, or it will be absolutely impractical.

The question of taking postgraduate instruction in conjunction with a general practice, as the essayist has outlined, is not satisfactory. In the first place, because there is an old saying that you can not do two things at once and do either one well. You can not conduct a general practice and study orthodontics at the same time satisfactorily.

The essayist has suggested that we give a course extending over a considerable period of time, devoting say four half days a week, or something like that, to the study of orthodontics, which will enable students to devote time to their general practices and at the same time take the course. I believe that we can accomplish more by intensive teaching in a short time than we can by stringing the instruction over a long period with other things to interrupt it.

He calls attention to the fact that in every large city the orthodontic specialist of recognized ability would serve on the teaching staffs of postgraduate schools. That has been tried by the Forsyth Infirmary. They have selected the men who should give instruction, but I know the majority of men who have been asked have refused. The man who

has a busy practice in orthodontia, if he is wise, will not fall in line with such a plan of teaching orthodontics. Men with large orthodontic practices will not devote a lot of time to postgraduate work. You have got to put this thing back on a practical basis. Men are not willing to make a definite sacrifice to teach in a postgraduate school. That is true in any line of teaching, and because a man is a successful practitioner of orthodontia or of any branch of dentistry or of medicine, is no sign that he is a good teacher. The worst failures in medical and dental colleges have been among the men who have been selected as teachers because of their large and successful practices. They have almost invariably failed as teachers. Teaching orthodontia or any branch of dentistry requires a certain amount of tact, a certain amount of preliminary training in normal schools, which the average orthodontist has not had. There is a large field for discussion which the essayist has opened up, and it will have to receive considerable attention. But a lot of the things he suggests are impractical, and they have been thought of a great many years before he suggested them.

Dr. W. J. Brady, Kansas City, Mo.—I feel that much more might be said on this subject, although Dr. Dewey has expressed my sentiments in the matter very thoroughly as I feel them. As many of you know, I have had some experience in teaching orthodontics, having put in twenty years on it under all sorts of circumstances in privately owned schools, in the large universities, and in privately conducted postgraduate schools, so, I believe, I may speak with some authority on the subject. While I am a graduate of a state university of which I am proud, and which I have later been honored by, being chosen as a teacher, and I regard this institution very highly, yet I know that with all the great resources of a state behind it, it fails to be competent to teach orthodontics as we would have it taught for specializing in the work. I know because I have tried it myself and because others have tried it. I did not have any success with it and they have not done much better. The reason, however, is not because the great university was supported by the state, but it is found in the fact that the average dental student does not possess the maturity to study orthodontics. Orthodontics is peculiarly postgraduate work, and it is only the men who have had opportunity to think, who have been compelled to think over the great many subjects, who are brought up in the postgraduate study of orthodontics, that have the real depth to undertake the work and to succeed with it. Now, those who have studied orthodontia in the private schools, the semi-privately owned schools, have done this thinking. They have done it whether they wanted to or not, and when they come to the privately owned school they are ready to take up intensive study of what must be given. For instance, a course of lectures can be given in six or eight weeks without any trouble, or without any particular trouble on the part of the men getting it. If they study it in this way after they have had the time to mature some of the problems, they actually get more and carry away more than if they have that same thing strung out for a considerable period of time, say a year or two years. Teachers in some schools do their best and have good opportunities to do their work, but students do not get it. Why? Why does not the three-year-old child, or the six-year-old child get trigonometry or Latin? Why is the child given the first reader? Because it is suited to him. He can only assimilate material of that kind. The dental student can only assimilate certain amounts of material, and therefore does not get orthodontics for that reason. Orthodontics taught in a regular course will not be a success for a long time. I wish it could be done tomorrow, but it won't be for a long time to come, and until that time comes certain men will have to get their instruction from men like Dr. Dewey, who has an organized school and teaches orthodontics. The only place where a knowledge of orthodontics can be had is in schools of that sort. Until we reach a higher educational plane, it will be the only place to get instruction of this kind for many years, not but that it would be desirable to have it elsewhere. Until the requirements are different, it can not be successfully carried out.

I am glad to have heard Dr. Dewey bear down on the practical side because practical things are what count with practical men, and men that have been in practice for a long time must be practical or they will go back to the milk wagon, the plow, or to the insurance agency where they are better suited.

I want to compliment the essayist because he has made an effort to bring about some things that he evidently feels deeply, and among them he feels that our present methods of orthodontic instruction are inadequate. The remedy does not lie in the planning out of the course to be given in a great university. I might say, that the big university is the hardest place to get anything done of any place on the face of the earth.

Give me the privately owned school when it comes to getting something. I have been there and I know. I know it is the experience of every man who has ever taught in any big university, that universities do not have money to carry on the various departments that they should have. Big universities are generally hard up, and the bigger the university the harder up it is from the standpoint of money, and so with that thought I will close.

Dr. C. A. Hawley, Washington, D. C.—I think we have had this subject very nicely and very clearly presented this morning and yesterday afternoon, and after that has been said I wish to say that the general feeling of the society has been expressed by Dr. Robinson regarding the practice of orthodontia. It is a matter of opportunity as Dr. Robinson previously expressed it. We should have greater opportunity for studying orthodontics than we have today. To my mind, notwithstanding what Dr. Dewey and Dr. Brady have said, I feel in regard to the teaching of orthodontia that there should be some institution in the United States where a man can take a postgraduate course in any subject in dentistry, at any time, during the regular school session, where he can study special work in pathology, where he can study all the different branches of dentistry, and with it orthodontics. I do not believe success would be as great in a one-man school as in a school where the instruction is given by different men, and in that school a course in orthodontia could be given. There should be men in charge of the institution, and students should have an opportunity to come in contact with a number of men, and it should be a school where a general practitioner can go at any time during the school session and get a certain amount of instruction. If he wants to take a six or eight weeks' course or a three months' course, he can take it; but there should be a definite course which is necessary, and my idea is that this course should be a year long to receive the recognition of the schools. I say a year long, because that time is necessary to get the clinical work and the practical experience one should have. Conditions are different today than they were ten years ago, and we know more today than we did ten years ago how instruction can be distributed. I think with some additions, the plan the essayist has outlined is one that will finally raise the standard of instruction in orthodontics higher, and will afford greater opportunity for the study of orthodontics under modern conditions.

Dr. D. W. Flint, Pittsburgh.—When a boy goes to a dental school he goes for a certain purpose—he goes to learn how to fill teeth and how to make plates, etc. In teaching I have found it is mighty hard to induce students to study something they do not want, and they do not realize the importance of what you tell them until the year is over, when it is too late.

I have been well pleased with the remarks of Dr. Dewey. He has discussed the subject both from a practical standpoint and from a large practical experience.

Dr. Ray D. Robinson, Los Angeles, Calif.—Dr. Dewey made one statement that I can not let go unchallenged, that is, when he said the reports of the state boards throughout the country show that private schools were giving better instruction than that given in the great universities. I want to challenge that statement. I know what the figures are; I have seen them. So far as the figures are concerned, he is right; but you know and I know that privately owned schools, whether small or large, are not giving the instruction that the great universities are giving.

Dr. Flint has just said that a young man goes to school for a certain purpose, and dental schools are organized for certain purposes. These big schools are organized to give instruction. A lot of these private schools are anxious to get their graduates passed the state board examinations, and their students are coached not to go out and practice dentistry efficiently, but they are coached to get by the state boards.

Dr. R. Ottolengui, New York City.—I ought not to take part in this discussion, but something was said that prompts me to do so.

I am glad to get in close touch with brother Brady. There are some university schools that are not beggars, but they have money. I have had opportunities at different times to become a teacher, but I have refused because being interested in and devoted to journalism I have felt I had a free hand in attacking them, if necessary, and pointing out their weaknesses. I have made it my business to examine schools and see what they are doing. I have been very peculiarly and deeply impressed with what I saw in the University of Minnesota which has caused me to change my views in certain matters. I have contended that dentistry is not a specialty of medicine, and that all the teaching a dentist needs can be taught to him in a dental school, but I have to back water a little

on that after visiting the University of Minnesota. I do not know where they get their money, but they have it, and as a result they have an enormous plant. Their pathologic building alone is larger than most dental schools, and as a result of it they can carry on research investigations and teaching at the same time. But the most impressive thing there to me was this: they have also a hospital which was primarily intended for the use of medical teaching, and through Hartzell and through the superintendents they found out there was some relation between oral disease and systemic disease. They finally gave the dental investigators three or four beds and now they have three whole wards, one for men, one for women, and one for children, all of whom are referred to the dental ward when they have diseases which may be explainable by dental trouble. Little by little dental offices have been established, so that they can operate in a dental way on some of these people. There is no doubt in my mind that if you can get the same kind of teachers as you have in the privately owned schools and add to them the advantages of a big university equipment, you will certainly be able to turn out a better product.

I think very largely the difference in the results shown in these university schools of their graduates passing or not passing the state boards is based on the fact that the university schools have large classes. For instance, a school sends six graduates from Illinois, and three of them fail, it is fifty per cent failure. On the other hand, if six of them pass the state board examination it is a hundred per cent success. These kinds of statistics are not comparable to a school that sends 150 for examination. The more men you have to teach, the more unteachable men you will have to deal with. It seems to me, the ideal thing that must come some day and will come, and it is in the minds of the Board of Regents of New York, is for the big universities in New York to teach every special branch in a building specially devoted to the teaching of that branch, but with the correlated diseases, and with all the equipment that a large university has without any stinginess in the matter of money.

Dr. Dewey is a little prejudiced in favor of the privately owned school. He knows what he is doing in his school, but he can look back to the days of the proprietary school in dentistry when the proprietors were out more for money than they were for making a fine product. As the doctor makes a lot of money in that school, a lot of other schools will spring up for the money there is in it and not for the product they expect to turn out. Just so long as he has a small school and has intensive study, it will be successful, but that does not prove that the privately owned school is correct.

Dr. W. C. Fisher.—There is very little to add to what I have already said in my paper. Dr. Dewey misunderstood me in some respects or I did not make the subject clear. I am not after the dental school to turn out a finished orthodontist any more than the medical school is expected to turn out a finished surgeon. It was not my idea to have the teaching of orthodontics incorporated in the dental curriculums; but graduates in dentistry should know more about orthodontics than they do today, then they will go to a postgraduate school.

Personally, I am not convinced that the dental departments of our large universities are turning out poorer material than private schools.

I referred to the two years' course only because of the fact that I want to see men take cases from the beginning to the end or until they see the finished product. I think we will all admit that in the most difficult cases, it takes two years for the man to see the results of a certain technic.

Again, we all lose sight of the poor chap in a small town of 5000 or 20,000 inhabitants. I was thinking of big cities where we can hold these postgraduate courses. We have a postgraduate school of medicine in New York, where a man can study one week, two weeks, or study only two days. He pays for it and leaves. I would like to see a school established where a man can stay long enough, if he has a certain definite curriculum, to receive a diploma from that school; but still there may be many of you, like myself, who would like to go to a highly organized postgraduate school and spend two or three weeks and brush up on some particular feature of our work. It does not mean that we have to go through the entire course. That entire course is for the man who has not been practicing orthodontics.

Again, Dr. Dewey speaks about the man who spends four years in a dental school, and on top of that takes a high school course, and says that such a man will not take a course of two years more in order to practice a specialty. Well, I think even the med-

ical colleges will have to cut down their preliminary education to get men out into the world sooner to earn a livelihood.

He says many of the students in colleges in working their way through college have got to practice. The man who wants to acquire knowledge so badly that he works himself through college will also work himself through a postgraduate course. If you can get good, conscientious teachers, and this organization bears testimony to that fact, for an eight weeks' course in a private school, it seems to me you can get good teachers for a postgraduate course under university supervision.

FREE ATTACHMENTS

BY CARL O. ENGSTROM, D.D.S., SACRAMENTO, CALIF.

MECCHANICAL ingenuity for many years past has invented a very great number of appliances for the correction of malocclusion of the teeth, and the claims made have been such as to create the idea that orthodontia is mainly the mechanics of an appliance. The mechanics of the appliance has been made quite distinct, for little attention has been given the mechanics of living tissue, although it is the most important. This has resulted in a misconception of orthodontia. It may be noted that of the interrelated subdivisions, the study of mechanics is but a part of the whole study of physiology. A most interesting part of these appliances has been the attachment (such as the connection of a band on a tooth to an arch wire), a part which has occupied a most prominent place in the consideration of appliances. It has seemed to be the aim to present an appliance with an attachment whereby every direction of movement of a tooth may be accomplished in the correction of malocclusion by the use of the one attachment. This, it seems, has led, no doubt inadvertently, to considerable disregard for the living tissues to which it was to be applied. It is not to be inferred that the attachment is the most important part of an orthodontic appliance nor that it stands alone in application to the principle to be mentioned; but that all parts are equally important and also enter into other physiologic factors in orthodontic treatment other than that stated herein. Neither should the thought be entertained that treatment should be made subordinate or in accord to the workings of an appliance, but rather that knowledge of living tissue should direct the use of an appliance which is merely an instrument in treatment.

To elucidate the subject, attachments are divided into two classes, free and fixed. While attachments have been considered mainly from the standpoint of moving an object through inert matter, the word "free" as used has little such mechanical significance, but rather refers to the phase of physiology to be presented. In this latter respect an attachment has an effect on the functions of tissues whether the tooth is being moved or not. Free attachment refers to any artificial means used to exert force to change or maintain the position of a tooth, which means does not prevent the movement of a tooth in the performance of its function, other than is necessary to the establishment or maintenance of its proper position. Free attachment is used in contradistinction to an attachment

wherein the tooth is interfered with in its function other than that which is necessary to its correction. This latter may be termed "fixed attachment." A ligature, properly applied, linking a tooth to an arch wire, and a wire in juxtaposition to a tooth are illustrations of free attachments; and a wire soldered to bands on two teeth illustrates a fixed attachment. Both free and fixed attachments have been extensively used. The last mentioned illustration can not be other than a fixed attachment, but a free attachment may easily become fixed when so adapted. The free attachment is one of mechanical simplicity, but it is often a very complex study to be considered as requiring the utmost knowledge, judgment and skill on the part of the operator.

Physiology should be the predominating factor in the consideration of an attachment; for fundamentally orthodontia is a study of physiology, particularly the physiology of all parts instrumental in mastication. Orthodontic treatment has for its object the improvement of function, the establishment of greater efficiency through structural changes. By structure, the orthodontist recognizes the physiology of the several parts. The activities of life, movement, and force in the one cell excite similar action in another cell. Cells live by functioning which when lost presages death. Health and efficiency of tissues are dependent on this interchange of forces. Force exerted on the crown of a tooth as in mastication excites force on the root of the tooth. This transmission of forces represents a function of the tooth. Of itself the tooth does not move, but is moved, and acts as a medium in the contraaction of forces. The form of the crown of the tooth and its many angles of resistance in the process of mastication are all reflected in the arrangement and movement of the fibers of the peridental membrane. The fibers of the peridental membrane allow for movement of the tooth in its bony alveolus. Function of the membrane is depicted in the arrangement of the fibers. This movement is the normal exercise of the membrane. If this is not to be considered in the function, then why this arrangement? Note the structure and it will be seen that this arrangement allows for movement of the tooth in many directions. By way of explanation, sixteen directions of movement of the tooth may be cited. The tooth may move bodily, mesially, distally, lingually, facially, in elevation, in depression, and in rotation on its long axis to the right and to the left. Considering the apex of the tooth as the axis, the tooth may move mesially, distally, lingually and facially; and with the crown as the axis the tooth may move in all of these directions. These directions, herein considered in the application of an attachment, also denote malpositions of teeth. As a rule combinations of these sixteen separate and distinct movements occur in mastication. It may readily be seen that a rigid or fixed attachment interfering with these movements would affect the health and efficiency of this membrane. The exercise of this membrane in the promotion of stimuli to the surrounding bone is important. The dependency of one function on another function is shown in the form of one structure and another. The function of this membrane is reflected in the surrounding bone and the character of the bone is reflected in the character of the attached muscle. Thus from a study of one part, the efficiency of other parts may be determined.

In the case of heavy mastication, all structures involved in the action

present formations in keeping with the great forces excited. There is a balance in the relationship of function and structure. Where all function is removed, as in the case of the removal of a tooth, those parts that possess no other function than that in conjunction with the tooth disappear and the structure of the remaining process reflects the change in use. If a tooth is held rigid as by a soldered attachment, in other words a fixed attachment, the surrounding structures will be altered just to the extent of the loss of function. As the function of one part affects the function of another, likewise, it is so of structure. The change in structure due to change in function may be noted in the case of a tooth that has been held stationary (it being understood that this state is not exactly obtainable in orthodontic practice) for some time and found loose upon removal of the appliance. Add to this loss of bony support that which occurs in the movement of a tooth by an orthodontic appliance, and is it not to be expected that the root of the tooth may be absorbed along with the surrounding bone? The proper function of cells is interfered with. The tooth by loss of function and being moved under the influence of a rigid attachment may be likened to a foreign body. Movement for correction under these conditions will result in more or less katabolic changes in the tissues. Often a tooth is presented wherein only one or two directions of force are required to place it in its proper position. Then why interfere with its fourteen functional movements? Such interference appears unscientific. Deciduous teeth may be moved by the use of free attachments with very little appreciable looseness.

While it is necessary to interfere with the normal movement of the tooth in the direction opposite to the direction of applied force, the aim should be to improve function with as little interference with the normal action of the parts as possible. The forces used in correction are less useful as the loss of function becomes responsible for a like condition of structure. In the correction of malposed teeth, they should be moved in the particular direction or directions necessary in the correction without needless interference with the functions of the tooth and of other tissues. This involves the application of the free attachment.

PRESIDENT'S ADDRESS BEFORE THE AMERICAN SOCIETY OF ORTHODONTISTS, SEPTEMBER 5, 1917

BY M. N. FEDERSPIEL, B.Sc., D.D.S., M.D., MILWAUKEE, WIS.

Professor of Oral Surgery in Marquette University.

PERMIT me at this time to express to you, the members of the American Society of Orthodontists, my deep appreciation of the high honor that you have conferred upon me in selecting me to preside over your deliberations. I would be happy indeed, but for the sense of unworthiness on my part to fill so high a position. I shall always esteem the presidency of our society, composed, as it is, of the leaders of orthodontic science and art in this and other countries, one of the highest honors conferred on me.

Carlyle has said: "The profession of the human healer is radically a sacred one, and connected with the higher priesthood; or rather, is itself the outcome and acme of all priesthoods, and divinest conquest of the human intellect here below—as will appear one day."

It is self-evident that the wisdom possessed of the art in treating human ailments, is the measure of the refinement and civilization to which the people have attained. Science in its broadest sense is synonymous with learning and knowledge. In early times when the knowledge of nature was small, it was not necessary to divide science into parts, and men of science did not attempt to specialize.

As the scope of knowledge and wisdom increased it was impossible for any one man to be familiar with all scientific subjects, so that there is a tendency to have a division and classification for a better understanding of certain subjects.

The accumulated experience of one department of science, and the special methods which have been developed to such a high standard to deal with its problems, become necessary in another department.

Geology uses the methods and data of physics, chemistry, and biology; Sociology needs biology, yet some group it with economics; the practice of medicine is nothing more than applied biology, which uses the methods and data of chemistry.

The high development of the different channels in the different sciences will ultimately bring about a better understanding that after all science is in reality one; yet we may approach it along various paths; we may view it now from one side and now from another.

The history of the healing art is as old as the history of the human race. Unfortunately the past has not preserved the name or any monument of the benefactor who first ventured upon the attempt to relieve the maladies of his fellow beings. To know this would be equivalent to knowing the origin of civilization.

What is regarded as learning, erudition, or wisdom, is a treasure which others have won and possessed before us. It is the promise of intelligence, to investigate causes and origin, to become free from the narrow limits between the cradle and the grave. We become broader, wiser, purer, and better for having learned of what has been. It strengthens our faith and ambition in regard to the future; we become liberalized, refined, and ennobled. By such eating of the tree of knowledge, the eyes become open, and the man is as a god. He makes the divinest conquest of the human intellect.

Orthodontics must be considered as a specialty, and to understand it one must be grounded in the fundamentals of the science. Unless one understands and appreciates the principles concerned in the handling of tissues, the causes and result of inflammation, the principles of mechanical engineering, the pathology of conditions that bring about malposition of the teeth and dento-facial deformities, prognosis as well as diagnosis and many, many other important factors, he can not have a complete understanding and properly manage orthodontic problems of everyday occurrence.

Orthodontics is far too serious a matter to be lightly undertaken by those who are not thoroughly trained in the fundamental principles underlying its proper performance. Yet it is of common occurrence among dentists to attempt the handling of orthodontic cases, who through flattering advertisements, by trade houses and mechanical laboratories, are led to believe that the correction of malocclusion and dento-facial deformities are free from perplexities upon the purchasing of certain appliances that are constructed, patented, and indorsed by some famous orthodontic wizard. I do not know of anything that is more vicious than this so-called patented cure-all appliance to undermine the progress of scientific orthodontics and degenerate it with a trade or slight-of-hand performance.

There is no such thing as orthodontics made easy; there is no trick about it that can be learned in a few weeks' course by making beautiful models and free-hand soldering, by watching the manual dexterity of some clever operator and admiring models and photographs before and after treatment.

It is so easy for young dentists to be led by such false gods into believing that a specialist can be manufactured by adopting a system and appliance. It looks so easy, and it seems to simple.

Right here I am reminded of the time when I was young and just out of a dental school. I had completed a few weeks' course in orthodontics, returning home with a diploma as a distinction of high training. I had the good fortune to meet a beloved teacher and friend, a man of wide experience and excellent judgment and possessed with a vision of broadness in its scope, not only being highly trained in dentistry, he was a wonderful physician and surgeon, the late Dr. B. G. Maercklein.

When I informed him of my intention to specialize in orthodontics he remarked: "My boy, remember that any ordinary orthodontist can move teeth; it takes years of study, experience, and observation to hold the teeth in their new position." It is well therefore, for a dentist before he poses as an orthodontist to weigh well the responsibilities that are involved. The inexperienced operator, owing to lack of proper training and insufficient experience is usually at fault in working out a clear diagnosis and prognosis. He attempts to do something that he is not competent to do. He places himself in a false position before his profession and the community.

Such a man reminds me of the young medical graduate, who through procrastination and having a rich father to rely upon, was not making much of a success as a medical practitioner; so he decided that a trip to Europe would fit him as a specialist. When he arrived at the Allgemeines Kranken-Haus, and was told that in order to be a specialist he had to knuckle down to hard, strenuous work, he was satisfied to let the other fellow use the microscope, while he enjoyed a student's visit at the beer table. After six weeks' sight-seeing in Vienna, Berlin, and London, he returned to his home town and introduced himself to the profession as a specialist with the following words: "I have just returned from over the seas, send your cases straight to me, I am a specialist, yes, by gee, and I belong to the state society."

I have observed, in my time, that quite a number of practicing dentists,

who have always been a flat failure in the practice of their profession, spend a few weeks in some postgraduate school and then pose as a specialist in some branch of dentistry. This sometimes makes me wonder that if the specialties are to draw their recruits from the failures in the mother profession, then we can not hope to look forward to higher achievements in the various specialties. The advancement in orthodontics depends entirely on the type of men that are enrolled in this field; therefore, it is necessary that the dental profession encourage that every dentist before entering a dental school must be possessed with a broad and liberal education so that he may understand and comprehend the interrelated sciences.

Travel as I may through this entire country visiting dental offices, I am more than surprised to find that the material comfort of the patient is very much in evidence while the scientific equipment is hopelessly in the minority. The most powerful weapon today in the hands of the profession against quackery of all sorts is a well equipped laboratory attached to the office of a dentist. The laboratory with a work bench, vulcanizer and casting machine must be enlarged to include a complete armamentarium to conduct proper investigations along bacteriologic and pathologic lines. While this may seem to add considerable more work, it makes the practice of dentistry of absorbing interest when one feels that he is approaching the study of a case equipped with modern methods. It is lack of accessories and inability to use them that makes so many men diagnostic misfits and careless in their treatment.

It is our duty, yours and mine, to see that dental education is limited to those institutions that can and do give proper opportunities to their faculties and students. We should see to it that public sentiment is aroused in support of this necessary advance. So long as the profession of dentistry, including its various specialties, tolerates our present day methods of dental education, and manufactures technicians instead of true scientists, quackery will predominate in its various forms.

The highly trained stomatologist does not have to yield to quack methods or does not become enthusiastic over the "cure-all" remedies that are so widely advertised in our trade journals and periodicals. Let me illustrate to you what happens to men who are not trained along scientific lines. Most of you will recall how so many physicians and dentists over this entire country became hysterical over the guarantee pyorrhea cure called emetine. Drug houses, anxious to reap a harvest while the reaping was good, sent out armies of drummers in the garb of the pseudoscientist to teach the poor dentist to fight the ameba buccalis and thus establish a pyorrhea cure. Trade dental journals were filled with advertisements of reports of cures; newspapers and weekly periodicals told of this wonderful miracle. Thousands of patients were given emetine injections by dentists and physicians, the whole country became emetine mad. This all happened long before research laboratories could tell of the merits or demerits of emetine.

Almost simultaneously with this emetine delusion another fad developed better known as the "tooth pulling rheumatic cure." Unfortunately many patients had teeth extracted that could have been saved through scientific

dentistry. The reason for the extraction of these teeth was that the dentist was led to believe that the interpretation of certain dark areas in a dental film was sufficient grounds to warrant immediate extraction, thereby removing the primary cause of the systemic condition. This brings me to the interpretation of dental x-ray. Strange as it may seem, the x-ray has been and is a much abused instrument. The roentgen ray was never intended to reveal the exact pathologic findings at root ends. The best that it can do is to aid us in our various tests to draw our conclusions. No man has a right to base his treatment on the reading of an x-ray picture without taking into consideration the various tissue changes that may take place in dental pathology. When men have a true understanding of the tissue changes that take place in acute and chronic inflammation and are familiar with the histopathology of morbid conditions involving root ends, then, and then only, can they realize that the dark areas involving root ends in the reading of a radiograph does not always mean a root abscess or a blind abscess; that the dark area may be nothing more than less density of bone, or an epithelial root tumor, or a root cyst, an innocent granuloma, a suppurative granuloma, an apical osteitis, osteitis fibrosis cystica, a rarefying apical osteitis, a root end necrosis, a root end cementoma, or a proliferative pericementitis. Unless a man has an understanding of these various pathologic manifestations he has no moral right to interpret x-ray films.

If dentists would have had a more liberal and broader education in the inter-related sciences, they would have then been in a position to point out to the advocates of this hysterical fad that it requires more than an x-ray film to make a differential diagnosis.

In our own specialty we have our fads. Our journals are filled with advertisements in which mechanical laboratories advertise their wonderful method of fitting appliances to models, of their orthodontic expert who is able to make a diagnosis and prognosis by the mere study of a crude model. I almost shudder when I think of the remarkable increase in the so-called "mail order orthodontic treatments" that is being carried on among dental laboratories. Then there is another fad that seems to have swept over this entire country, known as "the radical expansion of the supermaxillary bone in order to separate the palatal suture," thus giving more breathing space in the nasal channels for the patient who was supposed to be a mouth-breather. Rhinologists and dentists who had no understanding or training of the forces of occlusion became enthusiastic and laboratories were busy fitting jack-screws to models. Arches were widened regardless of whether the occlusion was normal or not. I know of one case where a so-called specialist went so far as to expand a normal arch for the purpose of trying to cure a case of otosclerosis.

It is ignorance, or lack of training, or to be spectacular, and a madness to extract American dollars, that has tempted young men to ignore the fundamental principles of modern therapy and surgery. Is it not high time that we clear the atmosphere of the things that are obnoxious to science, and devote more time in our literature and meeting places to studies that will develop the practitioner skillfully so that he may give his patients the benefit of all the accessories which are so important in the recognition and successful treatment of disease? There-

fore, I would recommend for your consideration that, if we are to develop along progressive ideas, we must encourage enthusiasm based on scientific investigation.

Some time ago our society had the pleasure of listening to a splendid paper which was read by Dr. Lourie, entitled: "Compromised treatments." It seems to me that when we review the literature in orthodontics during the first fifteen years, very little has been published upon mutilated cases and extreme malformations where it was impossible to obtain a complete restoration of the forces of occlusion. Strange as it may seem, the average orthodontist has not been doing his duty to encourage the treatment of this class of work. While it is fitting and proper to encourage the treating of malocclusion during the period of tooth eruption, we should, as specialists, be in a position to be ready at all times to diagnose, prognose, and treat these extremely complex cases, which have not had an opportunity to be benefited in childhood. We should endeavor to encourage the investigation and handling of these extreme malformations.

At the last meeting of our society held at Pittsburgh, Dr. F. C. Kemple, in his presidential address, called your attention to the need of standardizing our clinical records in the following words: "One of the weak points in the fabric of orthodontia today is the scarcity and incompleteness of our records of both treated and untreated cases. I am more than pleased to have on the program of this meeting a paper by one of our veteran members on the subject, 'The Records of an Orthodontist.' To my mind this is one of the most important subjects with which we have to deal, because of the fact that in the final analysis these records must form the very foundation of our knowledge of malocclusion."

Most of you will recall that splendid paper entitled: "The Records of an Orthodontist" read by Dr. B. E. Lischer, which was published in the March, 1917, issue of the *Dental Items of Interest*. Following the Doctor's address, the Forsyth Dental Infirmary requested the appointment of a committee to suggest a standard system of record cards, so that the enormous amount of material at the Infirmary might be standardized, classified, and made available for the profession. I sincerely hope that at this time the committee will be in a position to present, in concrete form, a report on this matter.

It is unfortunate that our society has failed to standardize our clinical records. If every member in this society would have carefully recorded his cases, during his orthodontic practice, we would then be in a better position to draw our conclusions in the diagnosing, prognosing, and treating of cases.

I wish to call your attention, at this time, to the need of revising our Constitution. At the last meeting a committee of three members was appointed to suggest corrections and revision of the Constitution and to report to the society at this meeting. I sincerely hope that the committee will make its report and that the matter will be given a free discussion on the floor.

While orthodontics has made remarkable progress and the literature is becoming voluminous, our terminology is being sadly neglected. If the American Society of Orthodontists is to be the representative society in orthodontics, then it should have enough pep and initiative in itself to go on building its own roads and bridges, to tell the world that it is on the map and that it is helping to write history in the pages of American dentistry. One of the most important matters

to be settled is a correct terminology. It is pathetic and pitiful to be associated among friends, who are supposed to understand the science of orthodontics, who can not write or talk intelligently on the pathology of oral deformities.

This, no doubt, is largely due to orthodontic provincialism. As long as we remain slumbering and unawakened and are willing to follow in the footprints of the egoist, we can not hope for scientific progress. Therefore, we should discourage within our membership the imitator who is willing to let well enough alone, who makes no advancement, but remains a parasite of the society. Right here I wish to quote the following from an editorial in the *Journal* on *The Imitator*: "The imitator is a vulture of human achievement. It is the dead hand that would paralyze initiative, stifle effort, and dry up the spring of hope and courage. It would perch in its somber garb over the cradle of new thoughts, new ideas, and great ambition. It would strangle in its icy grasp the great dreams of human progress, it would drape its banner of defeat over the forces of civilization, and would turn back in their course the stars of human grandeur." The future development of orthodontics, the standing we hold in the community where we practice rests entirely with us. I do not know of any way of uniting the society on a more solid foundation than by creating a spirit of enthusiasm in each and every member to strongly indorse the American Society of Orthodontists. This society may rightly be considered a clearing house, a means to an end, a post-graduate school, a representative society of progressive orthodontists, but there is much to be accomplished; like the battle of life, it means to struggle on, to blaze away, to learn to exchange ideas, to be familiar with orthodontia as it is practiced in this and other countries, to learn to give our patients all that orthodontics offers, to help the weak, to encourage the strong; to do this and more we must sacrifice ourselves to the task of laboring among our fellow practitioners in order to raise orthodontics to the high standard of which it is deserving.

The American Society of Orthodontists should be democratic and charitable, its doors should be open to all men who are willing to conduct themselves along professional lines. Political and star chamber sessions should be discouraged; men elected as officers should realize that they owe a duty to the fellow member in guiding the future of the society, to engender fraternalism, to help the weak and to encourage the strong.

DISCUSSION

Dr. C. A. Hawley, Washington, D. C.—I have only had an opportunity to glance at the paper a few minutes before the meeting, so that it will be impossible for me to present an extended discussion.

With the main tenor of the paper I am in hearty accord. The ideals on education are well worthy of the writer of this address. His statement of the dangers to which the science of orthodontia is subjected from imitators and from men poorly prepared is not overestimated; but, it seems to me, as a protection in our profession, as in other professions, we have the honest, honorable and thorough work of the best men; and the protection of the people lies in the honest work of men in our society, as well as other orthodontists throughout the United States. It seems unfortunate that we have no established school to prepare our men as we should for this work. It is unfortunate that Dr. Angle could not have continued his school and be enabled to carry out the high ideals in orthodontia which he established. We know that a man can not equip himself as an orthodontist in the true sense of the word after eight weeks or a few months of instruction. We should have a postgraduate school with a year's course and with a continu-

ous clinic, where cases can be observed from the beginning to the end. It is only in this way that we can have adequate preparation for the practice of orthodontia. Unfortunately that does not obtain at the present time. I think if this society could exert any influence in establishing such a course, it would be a good thing. I think we have a committee on education, which should be of some use, but I do not know how much work the committee has done.

Regarding another topic discussed in the address, namely, the revision of the constitution and by-laws, I am in hearty accord with what our President has said, and I think it would be well to appoint a committee in accordance with his recommendations to revise the constitution and by-laws and bring them up to date. There are some things in our constitution and by-laws that can be greatly improved, and I think it would be well to have a committee appointed at this meeting for that purpose.

I have been much pleased with the address.

Dr. B. W. Weinberger, New York City.—There is very little in the president's address with which I can disagree. There is one thing that I think ought to be brought up and considered, and that is the revision of the constitution and by-laws. A number of changes can be made which will benefit the society, if such a revision is undertaken.

With reference to the matter of general education of the orthodontist, this is a serious and important question. It is really a dream to think it can be realized at the present time under present conditions, but I believe if some action could be taken by this society designating what constitutes a specialist and who can be eligible in the true sense, as members of this society, it would be a great step forward in the science of orthodontia. There are a lot of small postgraduate courses that amount to absolutely nothing and I fear are doing a great deal of harm to the men who are trying to do sincere and honest work. I think that any action this society may take, if it is within its power to do so, would be a great help to these men in placing orthodontia on a definite scientific basis.

Dr. Martin Dewey, Chicago.—I have not very much to say in regard to the president's address because I agree with it, especially with regard to the revision of the constitution and by-laws.

As to the statement made with reference to postgraduate courses, I can not let it go unchallenged. Reference has been made to the inadequacy of present postgraduate instruction, one of the speakers saying that a postgraduate course of eight weeks is insufficient. If I remember correctly, some of the gentlemen present received their postgraduate instruction in such a school.

As regards the insufficiency of postgraduate work, Dr. Hawley made the statement that it is unfortunate the Angle school has been discontinued. We have all great respect for the Angle school, but some of us know that better courses are being given now than in the Angle school.

Another speaker (Dr. Weinberger) said that the present postgraduate courses of instruction do not amount to anything. That is an insult to a great many men who have taken these courses.

Several years ago, at the Toronto meeting of the society I was instrumental in getting a committee appointed to look after postgraduate instruction and to see the proper postgraduate course was given. This committee did absolutely nothing, so do not criticize the postgraduate schools, but criticize your own committee. The postgraduate schools have been more anxious to have a standing or to have a rating than the society has rated them by concerted action.

Dr. Weinberger.—Referring to the postgraduate schools in my previous remarks, I had reference more particularly to the condition we have in the East and no doubt elsewhere. In New York there are a number of dental societies giving postgraduate courses and sending men out who later specialize. Those men have had inadequate instruction; the courses are too short and slipshod, while the training is insufficient. Some definite action should be taken at this meeting with regard to these men who are turned out as specialists from such schools after a short course of instruction. That is the type of school I was referring to.

Dr. Hugh G. Tanzey, Kansas City, Mo.—I would like to comment briefly in regard to the experience necessary to do orthodontia as referred to by Dr. Federspiel in his address. It is generally recognized that we should know all we possibly can and have all the experience that is possible before commencing to practice orthodontia, especially before we make a diagnosis and give the prognosis; nevertheless, the fact remains that we can not all have a great deal of experience before we begin. I took a four or five

weeks' postgraduate course, if you will pardon the personality, after I had experimented with orthodontia for over ten years. Then I experimented two years more before I began to limit my practice, and I must admit the greatest failures I have ever had have been since I have taken postgraduate work and been limiting my practice. I do not think there is a man in this room who can stand up and say after all his experience he has not had failures in his work. The point is this: if you want to get anywhere in orthodontia or in any science, you have to make a start, and I would say to the young man, who has made up his mind to be an orthodontist, dive into it. I do not care what postgraduate work he does, if he is painstaking, he will work his way out, and if he is conscientious and has ordinary horse sense, he can do his work as well as the men who have had more experience. We are all having failures if we would only admit it.

In regard to the postgraduate schools that have been mentioned by Dr. Hawley and by Dr. Weinberger, I agree heartily with Dr. Dewey when he says that there are better postgraduate courses being given today than the course given by Dr. Angle. I do not see why the course of instruction should not be better. The men we have at the head of these schools today are ambitious, industrious, and conscientious. They are thinkers and hard workers and possess the knowledge and practical experience to back up what they teach. This course will be found good enough if we will back the men up and assist them in carrying on this course.

I agree with Dr. Dewey that the men who have taken such a course as he has referred to can not help but feel a little insulted at the remarks that were made. I am not referring to the short courses in orthodontia. Most men have taken at least one course, some of them two, and they are working to improve themselves, and that is about as good as can be done under the present conditions.

Dr. Hawley.—I took a six weeks' postgraduate course myself, but it would have been better had I taken a longer one. It was the best to be obtained at that time. A six weeks' postgraduate course is of value, but a much longer course, where students can not only put appliances on cases, but observe cases that have been under treatment, studying their progress from the beginning to the end, is of much more value.

Dr. Dewey.—Dr. Hawley has referred to a continuous clinic. In our school we have had a continuous clinic since 1912 the year round.

Dr. Ottolengui, New York City.—Any legal practitioner of dentistry has a right under the law to practice orthodontia; and when he voluntarily takes a postgraduate course in order to learn more than he was taught in the original school, it is a matter for his own conscience to decide whether it is fair to the children of the community in which he lives for him to announce that he will make a special practice of orthodontia. I for one would dislike very much to see the society set up any special standard of what a man should accomplish in order to be recognized as a sufficiently educated specialist to become a member of this society. The society is intended to be a helpful means of developing the education of men who wish to be specialists. It seems to me that one mistake which has been made in regard to postgraduate schools in the past, and I think this is what the president meant, is that the schools have left the impression upon their students that if they graduate from that particular school they would then be competent to correct any form of malocclusion. Later on, these men learn by experience that this is not true.

Dr. Calvin S. Case, Chicago.—I did not expect to be called upon to take part in this discussion. In the first place I would like to compliment the writer of this address in regard to what he has said concerning orthodontia.

I am quite in accord with Dr. Hawley relative to the question of postgraduate schools or any school of orthodontia, as some of the gentlemen present are doubtless aware. Whenever they have appealed to me for advice as to what particular school they should attend, I have referred them to Dr. Angle's school, believing it to be the best school at that time. By attending this school, it would give them a good start; it would stimulate them to go out and do better work. It is a mistake to think that a school stamps a man. It is the man behind the gun after all. No matter what school he goes to, if he has the desire and ability and the ambition to excel in orthodontia, that is all there is to it regardless of where he received his first training. If you will pardon a personal allusion, if I were stamped according to the teaching I received in a five months' course in the school I was graduated from in dentistry,—which you all know is very inadequate, the status of my professional life would be poor indeed.

Dr. Ray D. Robinson, Los Angeles, Calif.—This question of education, it seems to

me, resolves itself into one of opportunity. Some of us had six weeks' postgraduate work and some eight weeks. There is not a man here who has taken six or eight weeks of postgraduate instruction, who would not have taken a year's course had he the opportunity to do so.

In criticizing postgraduate schools of today, I do not think my friend, Dr. Dewey, will tell you that his school is as good as it should be. It seems to me the American Society of Orthodontists ought to support some postgraduate school. Whether it is Dewey's school, or another organized by this society. It is certainly within the province of this body to get behind an educational movement. If Dewey's school has the start and this society wishes to get behind it and push it and make it what Dewey would like to see it, then let us do it. If, on the other hand, Dewey's school has not the standing or the start, then let us organize one. Let us get some place where young dentists, who want to study orthodontia can go and get all there is to be given in our specialty.

Dr. Burt Adell, Toledo, Ohio.—The essayist has given us inspiration and food for thought, and we ought to be thinking along this line. No man who has taken a six or eight weeks' course feels it was sufficient.

When Dr. Dewey says there is a continuous clinic at his school, I would like to ask him if that is an answer to Dr. Hawley's suggestion. If these clinics are continuous, are they accessible to the men who have taken the course. I understand Dr. Hawley's contention was that when a man takes the lectures he should have a chance to develop the technic and he can do that through watching these particular cases. I do not think there is any school which affords that opportunity. I think most of us would be willing to hold up both hands in favor of a longer course. I have felt the need of it in my practice since 1903. If I knew a boy or a man interested in orthodontia, I would try to send him to a school that gives a longer course. I would do it because he needs it.

Dr. E. G. Weeks, Saginaw, Mich.—I took Dr. Dewey's course and as far as a continuous clinic is possible, I believe that is what we had the advantage of. I saw cases in all stages of treatment. Some cases I began, others I treated, as they had been started by other students, and other cases I retained. I saw cases in all stages of treatment, and I believe that is as near practical as you can have a clinic, and one which fulfills every need.

Dr. Ottolengui.—I am afraid that some of the gentlemen do not understand the situation in New York. While the First District Dental Society has been giving courses in orthodontia, they were study classes and orthodontia was but one of many subjects taken up in this matter for men who desired to hear lectures on special subjects delivered by experts. In orthodontia, there has never been any clinical work done and there never was any intention of stamping those who attend the lectures as qualified to practice as orthodontic specialists.

Dr. W. C. Fisher, New York City.—I am a student of orthodontia, while you are specialists. I consider that a man who desires an education in the present day in any science can get it. I do not think I have missed a meeting of this society for eight years or more. I come here in order to improve myself in the knowledge of orthodontics, and I have never left a meeting of this society without carrying away a good deal. I am surprised in these eight years I have not found more students of orthodontics at these sessions. Where the fault lies, I do not know. The lack of attendance is not due to the society not extending invitations. The first meeting I attended I was given the courtesy of the floor, which I have never availed myself of until this moment.

So far as criticizing postgraduate courses is concerned, I do not think anyone here wants to criticize them in a depreciatory manner. They have done excellent work, and must go on doing good work until you can improve them. The whole thing has been summed up by Dr. Waldron when he said that six weeks is good; eight weeks is better, a year is still better, and two years better yet.

Dr. G. W. Grieve, Toronto, Ontario.—This subject of schools has been discussed in this society before, and I think we all appreciate the fact that it is not possible to get all the knowledge we would like to possess in a short postgraduate course. It is a matter of long experience. If we apply ourselves, we gradually get there; but we make a lot of mistakes in the process, and, it seems to me, that this society should get behind a movement by which it is possible to establish a first class school in some large center in connection with a university, to get away from all commercialism entirely. We should try to establish it in some center where it is possible to obtain the services of men quali-

fied to teach in such a school. The course should extend over a year at least, and it should be given preferably in some university or should have some good backing behind it. The time must come when a school must be established along these lines in the right place—in a good university.

I appreciate very much the president's address, and I am glad he brought up the subject because that one feature of it has brought forth the main discussion, and it is an important matter which we must get behind and improve in some way.

Dr. Federspeil.—I appreciate very much the free discussion my paper has elicited. Some of you have misunderstood what I had reference to. My attack was on a class of men who are commercializing orthodontia. I had reference to the dollar school and the dollar orthodontist. It is unfortunate that you should attack this or that school, because if a man has a thorough early training in the fundamental sciences, it is an easy matter for him to master any specialty. He is then in a position to concentrate upon the teaching outlined in the curriculum, but the curriculum must be right, it must be broad and comprehensive and not limited to the advertising of a system or a man. I remember when I took my course in the Angle School of Orthodontia, we were supposed to use the author's appliances only, consisting of clamp bands, an expansion arch, and ligatures, with little or no knowledge of retention. It took me ten years to unlearn what I learned in six weeks.

This society has taken the lead in raising the standard of orthodontics; it is, after all, a postgraduate school; therefore, I would like you to be more democratic and charitable and to assist those who are weak in orthodontics. That is the purpose of our organization.

ORTHODONTIC APPLIANCES IN THE CORRECTION OF ALVEOLAR CLEFTS AND IN EMERGENCY TREATMENT IN WAR

BY H. C. POLLOCK, D.D.S., ST. LOUIS, MO.

ORTHODONTIC mechanical devices have been used in the past for the correction of alveolar clefts. Along with many other illustrations, Major V. P. Blair, M.R.C., U.S.A., in the third edition of his book on "Surgery and Diseases of the Mouth and Jaws," illustrates a case (Figs. 1 and 2), in which crude, but



Fig. 1.—The first cast (A) shows a wide unrepaid cleft at the age of eighteen months. The cleft is partially filled by a transverse part of the nasal septum that would prevent the maxillary bones from being drawn together. At the first operation this transverse part of the nasal septum was removed and the palate repaired by a von Langenbeck operation. As a result of the traction of the soft tissues across the bony cleft the palate became narrower, shown in cast (B) made three months later, but there was still a wide alveolar separation. Dr. F. J. Brockman constructed the orthodontic appliance shown on cast (B), with which, by means of an elastic band, the alveolar cleft was closed in two weeks, as shown in cast (C). Then the lip repair was made.

effective, orthodontic technic was employed in the correction of an alveolar cleft in an infant.

Orthodontists have realized the possibilities of orthodontic equipment in these cases; but it has been left for the war surgeons and dental surgeons to devise ingenious appliances of various kinds to meet their requirements for emergency treatment at the front.

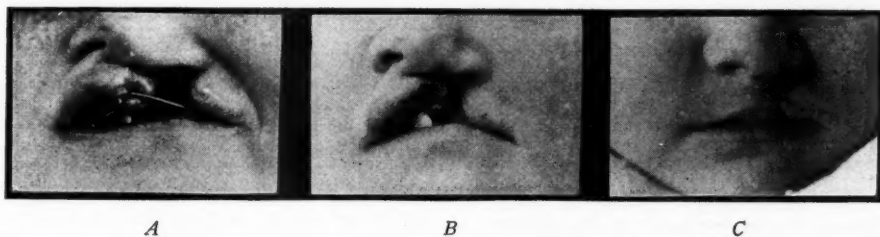


Fig. 2.—Showing the obliteration of the alveolar cleft by means of an expansion arch by Brockman.
Fig. 2-C shows the final lip repair over the closed alveolar cleft.

No surgical truth has received greater emphasis in this war than the necessity of correlating the skill and the knowledge of the general and the dental surgeons in the treatment of the combined injuries of the face and jaw bones.

In his book Dr. Blair points out and illustrates the various technical and mechanical devices that have been developed during the war for meeting the requirements of the dental and oral surgeons on the field. Competent technical assistance for those who have sustained injury of the face and jaws is most essential now.

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EDITORIALS

A Word of Caution in Regard to the Use of Wire-Stretching Pliers

SEVERAL years ago when Angle gave the wire-stretching pliers to the orthodontic profession, very few men accepted them as an important adjunct to the principles of practice. The possibility of increasing the length of the wire by pinching it, thereby exerting pressure upon malposed teeth, did not receive very much attention, except from Angle, until employed by Lourie, of Chicago.

Lourie carried the use of the wire-stretching pliers to a higher degree of efficiency, and demonstrated that the force of a pinched wire is capable of obtaining a great degree of tooth movement and producing results equally as satisfactory, in many cases, as can be obtained by any other appliance. To make the instrument more efficient, he made some changes in the design and began producing types of tooth movement which, up to that time, had not

been considered possible with the use of the wire stretchers. The results which he has obtained and the ease and comfort with which the patients wear these appliances have led a number of men to take up the use of this plan of treatment.

However, at the present time we believe a word of caution should be issued in regard to the use of the wire-stretching pliers in order that others may avoid some of the difficulties which we have observed some have encountered.

In the first place, in order to obtain a satisfactory use of the wire stretchers, the operator must be familiar with the instrument and know the mechanical principles upon which it works. In order to become familiar with the use of the pliers, we would suggest the construction of technical arches upon models, and experimentation upon these technical arches in order to observe the results obtained by the use of the wire-stretching pliers. We believe that a number of men place lingual arches upon teeth in an attempt to produce movement by using the wire-stretching pliers before they have mastered the technic of the pliers or become familiar with the technic of lingual arches.

We believe that the same line of technical experimentation should be carried on with the use of the wire-stretching pliers that is followed in any other line of dentistry. Hardly anyone would attempt to make a plain band before experimenting and soldering the band, nor would anyone attempt any other line of dental operation without having a technical education along that particular line. Therefore, we believe much harm will be avoided, and much more satisfactory results obtained, if men will make technical arches for their cases, and experiment upon them with the wire-stretching pliers before they attempt to get practical results.

The wire-stretching pliers consists of two beaks, which are so shaped that they will be parallel and that they will close parallel over certain gauge wire. We would caution the profession that a wire-stretching pliers which has been manufactured with adjustment for use on a 19-gauge wire will not work satisfactorily on a 17- or 18-gauge wire. The reason for this is that at the completion of the pinch, the beaks must be exactly parallel to produce the greatest efficiency. It must be further remembered that to have a wire that has been pinched remain perfectly straight, the beaks must pinch the wire parallel to each other; second, they must be put at right angles to the wire; and, third, the beaks must be the same diameter. Care must also be taken to avoid moving the handles of the pliers in any direction during the time the wire is being pinched. A movement of the pliers in any direction during the pinching of the wire will result in a change in the shape of the wire, which will produce tooth movement very often undesirable.

Wire-stretching pliers may have the beaks plain or grooved, but in either case the beaks must possess the parallelism that we have mentioned previously. Lourie places a groove, or notch, in the end of the beak to increase the efficiency of the wire-stretching pliers. This groove must be so placed as to grip the wire, and the grooves must be opposite and parallel to each other and consist of equally curved surfaces. The groove also assists in placing the parallel beaks of the pliers at right angles to the wire which is to be pinched. The wire-stretch-

ing pliers are to be used to pinch a wire that lies close to the surface of the tooth, and it must necessarily follow that the notches in the beaks must be so near the end of the beaks that the concave surface will be in the center of the wire and not on either the buccal or the lingual side.

It does not make any difference what kind of wire-stretching pliers is used, whether the beaks are plain or grooved, but the beaks must be parallel to each other at the time of the finishing of the pinch. In other words, pliers must be so constructed that the beaks will not close entirely; and, if adjusted for a 19-gauge wire, the beaks must be parallel at the finish of the pinch or when they have reached their greatest efficiency. If operators are using different gauges of wire for the lingual arches, it necessarily follows that they must have different pairs of pliers adjusted for the different gauges, according to the rules we have outlined. It must also be remembered, when pinching the wire, both ends of which are soldered to a band, not to make too many pinches at one time. The wire-stretching pliers should make pinches at different points on the wire, and, after the surface of the wire has been covered by those pinches a certain distance from each other, one can then go back and place pinches in between those already made. Owing to the fact that the beaks of the pliers are only parallel at the time of the closing, the greatest degree of efficiency will be obtained in making the pinch always the same depth, because, if made shallow, more of an indentation will be made on one side of the wire than on the other, and, therefore, will have a tendency to curve the wire.

We would also caution those who purchase wire-stretching pliers to see that the beaks are so shaped that the sides are parallel to each other, or, in other words, are cylinder-shaped beaks, not cone-shaped beaks. The handles must also be adjusted by a set-screw, the beaks filed, or dressed down, until they are parallel to each other at the finish of the pinch. After the pliers have been set to fit a certain sized wire, it should be used only on that sized wire.

We believe that by following these few basic principles and mastering the use of the wire-stretching pliers on technical models and technical arches, better results will be obtained than if we attempt to use the pliers, without becoming familiar with the mechanical principles employed and the peculiarity of a pinched wire, the ends of which are soldered rigidly to the bands.

Section of Surgery of the Head

THE medical care of one million troops in the field will require the services of several thousand physicians. The Medical Corps of the regular army, one of the most carefully selected organizations of medical men, was not sufficient for the present emergency. Primarily, the corps was augmented numerically by the organization of the Medical Reserve Corps. By a careful distribution of the men of the regular corps, the influence of their long and thorough training permeated the new organization, forming a completed organization in which those inexperienced in military medicine were safely supported. The Medical Reserve Corps organized, the profession realized its responsibility, and,

in consequence, commissions were issued to a large number of physicians throughout the country.

Many of the members of the Medical Reserve Corps were detailed to various Medical Officers' Training Camps for the purpose of intensive technical and physical training. This assignment afforded the officers opportunity to obtain physical fitness and sufficient military experience to qualify them as regimental, ambulance, and sanitary officers. It also permitted the weeding out of the physically unfit, but did not afford opportunity to classify officers according to their professional attainments. The details of this training so consumed the time of instructors and students that it was impossible to judge of the fitness of the officers for special work.

Recognizing the need for specialists, the Surgeon-General, with the General Medical Board of the Council of National Defense, through the great medical bodies of the country, established in his office sections for the care of the various medical and surgical specialties. Physicians of high professional rank, many of them authorities in their chosen field, and in civil life acknowledged leaders, were selected to direct these sections. This plan of classifying the personnel of the military medical corps, a new departure, is another example of the far-sighted preparation now so conspicuous in every branch of the service.

The various needs of the service demanded the establishment of eight sections; namely, Internal Medicine, General Surgery, Orthopedic Surgery, Venereal, Skin and Genito-urinary Surgery, Surgery of the Head, Laboratories and Infectious Diseases, Neurology, Psychiatry and Psychology, and Roentgenology.

The Section of Surgery of the Head, made up of the Subsections of Ophthalmology, Oto-laryngology, Plastic and Oral and Brain Surgery, developed from a similar organization of the General Medical Board of the Council of National Defense.

In the office of the Surgeon-General, the section as a whole is under the direction of a Lieutenant-Colonel of the regular corps, and to each subsection is assigned a member of the Medical Reserve Corps. These officers act in an advisory capacity in the selection of personnel, etc., and outline the policies under which the work is to be carried on.

Those in charge of Ophthalmology and Oto-laryngology found their chief function in acquainting the physicians of the country with the fact that the Surgeon-General was desirous of using the specialist, as far as possible, in his specialty, and in listing the names of the physicians who came into the Medical Reserve Corps with a view to work in their specialty. They have aided the Surgeon-General to select and assign the proper personnel to the base hospitals at the various cantonments. At the present moment, the selection of the personnel for the base hospitals, which are destined eventually for duty abroad, engages their attention.

The officers in charge of the Subsection of Plastic and Oral and Brain Surgery were confronted with the fact of the great scarcity of surgeons familiar with the special technic so necessary in the successful management of injuries of the face and head. It was necessary to use this small group of qualified surgeons to instruct others, and thereby build up a corps of sufficient size to enable

assignment of specially trained surgeons to the various hospitals. A conference of the recognized authorities, held in Washington, developed the fact that the large universities were willing to assist in this professional training by tendering to the Surgeon-General the facilities of their medical departments and hospitals.

Schools, with teaching staffs of surgeons versed in the details of special branches were established. The course of instruction includes anatomy, physiology, symptomatology, operative exercises on the cadaver and animals, splint making, clinical demonstrations, and didactic lectures.

In the selection of students, the Subsection of Plastic and Oral Surgery first considered a group of surgeons commanding excellent technic, but lacking in the necessary special refinements; secondly, the members of the dental profession, many having medical degrees, who have concentrated their studies upon peridental tissues, the jaw bones and structures of the mouth, and consequently familiar with the special details of the treatment. The correlation of the technic so as to enable the individual surgeon to command the combined knowledge can well be accomplished in these courses.

In a like manner the successful neurologic surgeon must, in addition to his general surgical training, have some knowledge of neurology and be trained in the special technic of surgery of the nervous system. The imparting of this special training could best be accomplished by similar schools. With the assistance of the leading members of the profession throughout the country, a list of candidates for these schools has been compiled. These candidates, in groups of twenty-five are assigned to the schools for a period of intensive fundamental training. When this course is completed, it is planned to give the more competent surgeons an opportunity to continue studies in the various clinical centers of the country. Selected groups of these officers, well-grounded in the fundamentals, can later be more specially qualified through a course of clinical instruction at the front.

In this manner the important period of preparation so necessary for the accomplishment of rapid expansion of all branches of the service, will be most wisely used.

When the troops are engaged and many beds of the various hospitals are occupied by soldiers with injuries of the head, assignment of these surgeons, who have had special training, to assume the responsibility of these cases should result in the utmost efficiency. In the unit for plastic and oral surgery a general surgeon will have associated with him a dental oral surgeon, who, having gone through a course of intensive training, will be fitted to obtain the very best results through their correlated skill. Likewise the officer of the Subsection of brain surgery, necessarily somewhat divorced from the competent neurologist, will have keen judgment and undertake with clearness his responsibility.

The fact is evident that it is not the intention of the Surgeon-General to make special surgeons by means of a short course of instruction, but add the necessary special knowledge to the equipment of surgeons. This special knowledge will not interfere with the general usefulness of the surgeon in the performance of any duty which may fall upon him as a member of the Military Medical Corps.